SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1902, by Munn & Co.]

Vol. LXXXVII.—No. 23.
ESTABLISHED 1845.

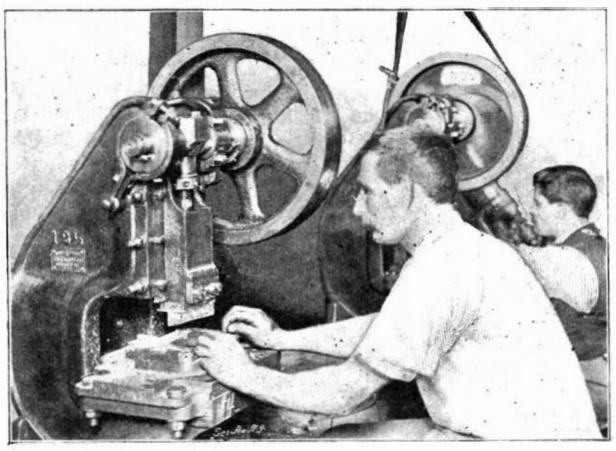
NEW YORK, DECEMBER 6, 1902.

8 CENTS A COPY.
$3.00 A YEAR.

Casting a Doll's Head.

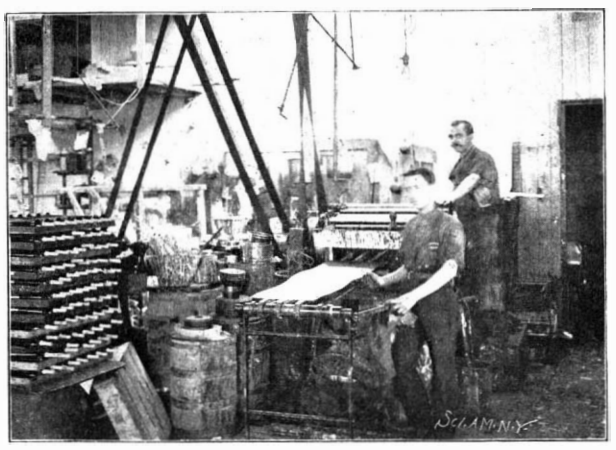
Paring off the Seams from a Doll's Leg.

Stuffing and Assembling the Dolls.



Power Press for Stamping Out Tin Toys.

Painting in the Eyebrows of a Doll.



The Painting-Machine.

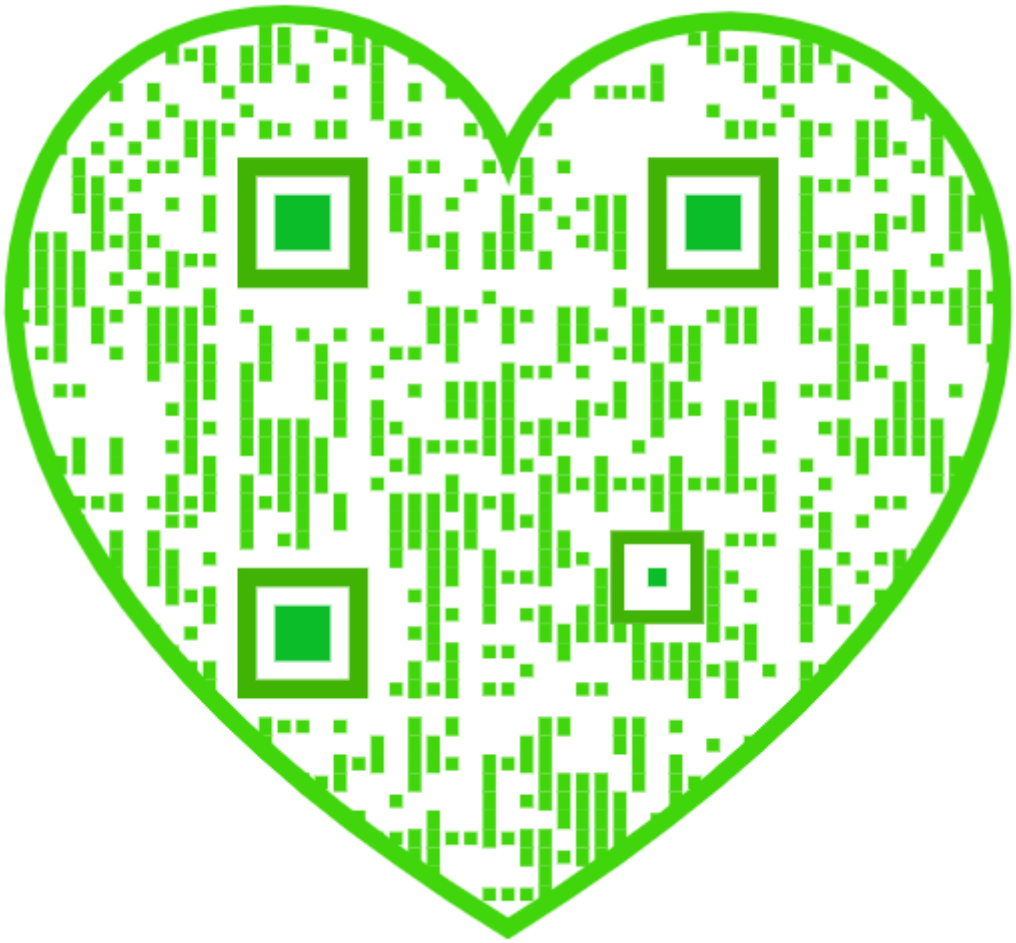
Painting the Kitchens.

The Completed Product.

Painting Toy Cars.

THE MANUFACTURE OF TOYS AND DOLLS.—[See page 376.]

© 1902 SCIENTIFIC AMERICAN, INC.



SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845)..... $3.00 a year
Scientific American Supplement (Established 1876)..... 5.00 "
Scientific American Building Monthly (Established 1885)..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, DECEMBER 6, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE PENNSYLVANIA RAILROAD TUNNEL.

The attitude of the Board of Aldermen of this city in holding up the franchise for the construction of the Pennsylvania Railroad tunnel beneath Manhattan is one of the most shamefaced exhibitions of political tyranny that ever disgraced the city of New York. Here is a great corporation which offers to remove the insular disadvantages under which this city labors, owing to its being cut off by the Hudson River from direct railroad communication with the West, by building, entirely at its own expense and at a cost of something like $50,000,000, a vast engineering work on which, for many years to come, it cannot hope to realize a penny of interest. The tunnel will be built at such a depth below the street grade that there will be practically no interference with traffic, and but very little surface indication that such a vast excavation is being made. From the point of view of transportation the gain to New York city will be simply enormous; and as to the question of rental, there have not been wanting many prominent citizens, and especially those who understand transportation problems, who have declared that the charging of any rental whatever to a company that is voluntarily providing such a beneficial scheme to the city, is altogether unwarranted. The ultimatum which has been presented by the lawyers of the Pennsylvania Railroad Company, stating that if further opposition develops they will drop the scheme altogether, is perfectly natural. While we should greatly regret to see the threat carried through, its execution would be a logical outcome of the exasperating and disgraceful tactics employed by the Board of Aldermen.

TEST OF THE MAXIMUM CAPACITY OF THE NIAGARA FALLS TUNNEL.

In order to ascertain beyond any question of doubt the tailrace capacity of its tunnel, a most interesting test was recently made by the Niagara Falls Power Company. This tunnel is 7,436½ feet long, 21 feet high and 18 feet 10 inches wide. When ground was broken for it, the idea prevailed that it would not have to be lined, but later it was found that a portion of the rock through which it was constructed was so soft that it might possibly be worn by the rushing water. For this reason and in order to make it perfectly substantial, the tunnel was lined from end to end with four courses of brick. In the rough, the tunnel was to have had a capacity of 120,000 horse power; but the lining lessened its capacity, so that it has always been rated at 100,000 horse power.

While not doubting the correctness of the calculations of the eminent engineers who had to do with the tunnel construction, the opportunity presented itself on November 19 for testing the tunnel by sending through it an amount of water equal to the quantity that would be used by the perfected installations in the development of 100,000 horse power. By making a test the Power Company would know by actual practice what up to that time had been theory. While the first six units in the new station will probably be in operation within the next three months, the complete installation will not be in service until the latter part of next year, so by its test of the date referred to the Power Company now knows under just what conditions its tunnel will operate when the flow of all the turbines is passing through it.

The quantity of water sent through the tunnel on the occasion of the test was twice as great as many notable rivers carry. Still, it was only a very small fraction of the water that comes down the upper Niagara from Lake Erie. Observations showed that its diversion was not noticeable on the brink of the cataract, the beauty of which was unimpaired. The test began at 10 A. M. and lasted until 5 P. M., giving ample opportunity to observe the effect on the river, the currents and falls, also the conditions existing in the wheelpits and tunnel.

The discharge at the portal of the tunnel was a most interesting spectacle. The stream from the tunnel extended clear across the river to the Canadian shore, and it was noted that a portion of the surface current passed upstream and a portion of it downstream. Between the top of the arch and the rushing water at the portal considerable space was shown, the entire semicircular arch remaining above water. The test was announced as a success in every particular.

Those who observed the test were of the conviction that one result from the discharge from the tunnel, when 100,000 horse power is being developed, will be that the flow of water will serve to hold back the ice that comes over the falls from Lake Erie, and aid in forming ice bridges of far greater magnitude than have been witnessed at Niagara at any time in the past. If this proves true, no doubt many interesting ice conditions will be seen in the Niagara gorge.

THE GUN IN NAVAL WARFARE.

We have heard so much of late years about the wonderful efficiency of the modern breech-loading rifle, that one feels something of a shock of surprise to learn from the lips of a Lieutenant-Commander of the United States Navy that in future wars it will be only pure good luck that one ship will sink another by the power of her gun-fire. The late annual gathering of the Society of Naval Architects and Marine Engineers was marked by one or two rather startling papers, among which one on "The Tactics of the Gun," by Lieutenant Commander A. P. Niblack must be reckoned. The writer defined a battleship as being, when reduced to its simplest terms, a floating gun-platform. Considered as a unit of defense it contained, on a given displacement, the maximum of concentrated destructive power, first for giving battle on the high seas, and secondly, for attack on an enemy's coastline. The author of the paper believes that if ships are to be sunk it will be done by the ram or torpedo, whose special province it is to penetrate the underwater body of a ship, destroying its watertight subdivisions, and by letting the water into the "vitals"—engine or boiler rooms, or magazines—either putting it out of action, or sinking it altogether. On the other hand, the province of the gun is to deal with the above-water portion of the ship, putting out of action the guns, gun mounts, ammunition hoists, etc., and destroying the officers and gun crews. It is argued that as long as the motive power and steering gear of a warship and such personnel as is not engaged at the battery are intact, it is almost impossible for the guns alone to destroy the vessel. When Mr. Niblack says, "It is only by luck or by indirection that a modern battleship can sink another by gun-fire alone," it is evident that he has in mind the results shown by the examination of the Spanish vessels which have been raised since the battle of Manila Bay, and also the results of gun-fire as shown on the ships sunk at Santiago. "We need not," he says, "in the future expect to set ships on fire by gun-fire as at Santiago and Manila, and, indeed, we have a long way to go before we can expect to achieve victories over our next adversary." Of course, it is well understood that the great destruction of the Spanish fleets was due to fire started by bursting shells, and in what he says above, the writer has in mind the fact that modern warships carry practically no combustible material in the way of inflammable decks, bulkheads and fittings. Hence, we cannot expect, should we engage in another naval war, to see the enemy's vessels burning up before our very eyes after the first fifteen minutes of an engagement. The present situation as regards the tactics of gun-fire is stated succinctly as follows: Bow-fire has become a great factor in modifying tactics. The ram is more than ever a dangerous weapon. Armor has almost nullified the great danger from raking fire at close quarters. The torpedo has made it dangerous to fight at closer range than 1,000 yards. Smokeless powder and high speed make the windward position of little importance compared with getting the sunlight on the enemy and in his eyes. Elaborate subdivisions in ships tend to prolong the time and increase the difficulties of the destruction of a ship by any weapon.

Gun-fire, then, being concerned mainly with the destruction of batteries and personnel, the author of the paper goes on to show that the public does not realize the horrible destructiveness of modern gun-fire. What our fleet accomplished at Santiago was done with only four hits out of every one hundred shots fired; yet since that day, "both ordnance and gunnery have been almost revolutionized, and methods good enough for 1898 are an invitation to-day to disastrous and bitter defeat." To illustrate how gunnery has improved in the past three or four years, and how terrific must be the hail of projectiles in a future engagement, Lieutenant Commander Niblack instances the progress made since the war in the British Navy in the matter of target practice, and he quotes official records of the annual prize-firing contest for last year. A target 20 feet long and 16 feet high was anchored at a distance of about one mile from the course followed by the contesting ships, each of which steamed by the target at a speed of 12 knots and fired for two minutes with each 6-inch gun, firing one gun at a time. According to the official reports, the average of forty-eight ships was nearly two hits per gun per minute. The best fifteen ships made from two to four hits per gun per minute. This means that eighty-two 6-inch guns fired eight hundred and sixty-seven projectiles in two minutes and made 518 hits, or nearly sixty per cent. The battleship "Ocean" averaged nearly five hits a minute, while one of her gun captains fired nine shots and made nine hits in one minute. This, Lieutenant Commander Niblack states, is easily the world's record, as it means less than seven seconds between aimed shots. One gun in particular fired seventeen shots in two minutes and made fifteen hits.

"Just now," says the author of the paper, "the navy needs unusual and heavy expenditures for ordnance." This somewhat pessimistic view of the condition of our navy may seem puzzling in view of the abstract of the report of the Bureau of Ordnance given in our last issue, in which it was shown that our new guns are fully the equal of any that have been built abroad. Mr. Niblack, however, is referring to the number of ships of our navy that are carrying the older types of weapons, shells and powder, which, although excellent in their day, have become outclassed by modern material. He says that owing to the pressure of the past five years, some of our ships have been in continuous service for that period, and everyone of these needs a thorough overhauling as to battery and ammunition, and particularly as to ammunition, as they have on board a heterogeneous lot of brown powder, smokeless powder and projectiles collected from various sources, most of it for the war with Spain. These are matters that can easily be remedied if Congress will only grant sufficient appropriations to renew these older batteries and replenish the magazines with modern shells and powder. A good beginning has been made in this work, and it should be carried through with regard to every ship on the active list of the navy.

THE DEATH OF FRIEDRICH KRUPP.

The death of Friedrich Alfred Krupp, head of the iron and steel industry of Prussia, removes the most conspicuous citizen of the German Empire and one of the greatest manufacturers of the world. The reputation of his works for fine artillery earned for him the name of the "Cannon King" in Germany.

Friedrich Krupp was born on February 17, 1854, the son of Alfred Krupp, who inherited the works at Essen from his father. The first of the steel-making Krupps began work at Essen with two laborers in 1817. When the late Friedrich Krupp became the head of the firm he found at Essen a well-established business which he developed into a world-wide enterprise. The Krupps will always be remembered as great steel makers and as armorers of the world's fighting forces. That was the work of the "Cannon King."

The Krupp works are vast in extent. The real estate belonging to the firm amounts to 900 acres, of which 150 are covered by buildings. The daily output of the works amounts to about 1,877 tons. The late Herr Krupp had the general management of these gigantic works; but the various branches were placed in the hands of a board of twelve directors, who were responsible to him for all the departments, numbering about one hundred.

Friedrich Krupp was the richest man in Germany. Yet he had been accustomed all his life to toil with both hands and brains.

"From my fourteenth year," he once said, "I had to care like a father for my family during the day added to hard work at the factory. At night I had to study how to overcome the difficulties in the way. During this period I lived on potatoes, bread and coffee and scant portions of meat, and toiled until late in the night. For twenty-five years I struggled thus, until conditions grew a little easier. My last remembrance of that period is the growing danger of total ruin and my endurance, suffering and hard labor to avert the calamity; and I say all this for the encouragement of young men who have nothing, are nothing and want to get something and be somebody."

The Krupps have always been known for the interest they have taken in the welfare of their employes. But the "Cannon King" so far excelled his predecessors in this respect that he was more than once accused of harboring socialistic principles. It was Friedrich Krupp's father who started the system of modern dwellings for workingmen as an experiment. The late Herr Krupp himself appears to have developed them from conviction and in accordance with his ideals. He owned 5,469 dwellings, each being constructed differently to avoid architectural monotony. All the houses have front yards with beds of ornamental gardening. Besides convalescent hospitals and orphanages, Fried-

© 1902 SCIENTIFIC AMERICAN, INC.

rich Krupp maintained a pension fund for his employes, amounting to $4,125,000.

Notwithstanding his vast benevolent interests, he is said to have been an autocrat in the management of his affairs. He was almost unknown by sight to his workmen, and rarely visited the works or even his offices. Unlike his father, he took no interest in the technical side of his business, and yet in fifteen years he more than doubled the fortune which he inherited.

AN AMERICAN PARALLEL TO THE TULIP CRAZE IN HOLLAND.

BY IRVING U. TOWNSEND.

Probably few persons not thoroughly conversant with the history of the silk industry in America, are aware that the tulip mania which raged in Holland nearly three hundred years ago, had its counterpart here two hundred years later.

Five hundred dollars was often paid for a bulb of the Admiral Liefkens or of the Gouda variety, $1,000 to $1,200 for a Viceroy, and $2,000 for a Semper Augustus during the mania. In 1634 the craze became so great that all usual industries were abandoned. A choice bulb sold for $1,900 in cash, two horses, a carriage and a set of harness, representing in all $3,000. Persons frequently invested $50,000 in a few dozen bulbs with which to begin business, mortgaging their houses or giving personal property in exchange. These extraordinary values checked the cultivation of tulips, as the bulbs could be bought and at once sold at a profit to speculators. Finally the real tulip lovers became disgusted and in February, 1637, suddenly placed large quantities of the most valuable varieties upon the market. This produced an immediate and disastrous decline in the price of bulbs. Without a day's warning, thousands found themselves ruined. It was several years before Holland overcame the effects of this strange mania.

Now comes the analogy. James I., who almost insanely hated tobacco, was determined that silk worms should be reared in Virginia, mainly because he thought he could thus destroy the tobacco culture, which he ordered to be abandoned. Some silk was produced and sent to England. The coronation robe of Charles II. was made from such silk. During the next hundred years there occasionally appeared a waistcoat or handkerchief of a Colonial delegate, made from homespun and woven silk, and sometimes grand ladies were arrayed in gowns of native-grown silk. For a time silk culture met with great success in Georgia. In 1759, 10,000 pounds of raw silk were thence exported to England. Connecticut was, however, the center of the industry. The Legislature offered a bounty for planting trees. As late as 1825 the culture of silk was very general there and also flourished in Massachusetts. In Pennsylvania it was undertaken and continued with success until the Revolution.

Silk worms were fed on the white mulberry (*Morus alba*) until 1830, when there appeared the Chinese mulberry or *Morus multicaulis*. Dr. Felix Pascalis made known the remarkably rapid growth and the supposed excellent qualities of the tree, thus opening this Pandora's box whence so many evils escaped. It was predicted that by its culture two crops of silk could be raised annually. It had large, thin, tender leaves; it could be propagated easily by cuttings and cultivated as a shrub; and it was claimed that its leaves formed the most nutritious food for silk worms. Soon all the agricultural literature and the newspapers of the country became surfeited with descriptions of this wonderful tree.

At this very time Congress was considering the subject of silk culture. In 1825 the country had imported silk goods valued at $10,000,000, and had exported breadstuffs worth only $5,000,000. This was considered an alarming state of affairs. Secretary Rush of the Treasury was directed to prepare a manual on the growth and manufacture of silk. This was issued in 1828 and known as the "Rush Letter." Many documents relating to sericulture were published by Congress. A Congressional committee recommended that all public lands be leased gratuitously to those who would undertake the cultivation of the mulberry. A bill barely failed of passage that authorized an expert to instruct the farmers everywhere how to cultivate the *Morus multicaulis*. The Massachusetts Legislature ordered the preparation of a manual on silk culture which was very potent in fomenting the craze. The legislature of nearly every State provided for the payment of liberal bounties for planting mulberry trees and raising cocoons.

Thus it was that a speculative furor, a veritable madness, seized upon all classes of people, and particularly—of all men—upon the shrewd, calculating Yankee. It raged like an epidemic. Not only agriculturists, but doctors of divinity, law and medicine, scholars, tradesmen and mechanics, men and women, old and young, were infected with an insane passion to raise mulberry trees. Every one thought the glorious day was dawning when each farm would be a nursery for the young trees, and every house have its cocooneries and its silk worms yielding two or more crops of cocoons yearly. The farmers' wives and daughters, when not feeding the worms, were to reel the silk which would become as cheap as cotton, every woman having at least a dozen silk dresses. A writer of the day said, "You can scarcely go into a house but you find the inmates engaged in feeding worms."

The large profits anticipated in producing silk were insignificant compared with the fortunes that all expected to make by raising the new mulberry tree. This was planted in close hills or in hedges, it adorned highways, and rarely was a garden or any cultivated spot to be seen without it. In 1834 trees of a season's growth were sold for $3 to $5 a hundred, but they soon sold at $25, $50, $100, $200, and $500 a hundred, and sometimes $7 apiece. There is recorded an instance of two trees of one season's growth, raised by one Elder Sharp in North Windham, Conn., which were sold at auction. The first brought $106, and the second $100. Further sales were then withheld because the bidding was not considered to be sufficiently spirited.

As cuttings with buds or eyes were sufficient for planting, slender switches two feet long sold for $25 a dozen and were declared to be worth $60. In fact, the value of the trees became greater than that of the silk which they could by any possibility produce. They became worth too much to be used for silk culture. When the craze reached its height, but little silk was produced for every one was busy raising the new mulberry tree. The speculation in planting, buying and selling trees withdrew attention from the more legitimate business of raising silk worms. Men expected to make fortunes in a few months buying land and planting mulberry slips, and the silk companies almost without exception sank their capital in this way, many fully equipped mills being closed.

One farmer planted $1,000 worth of trees in ¾ of an acre and sold them the next year for $6,000. Elsewhere the trees upon two acres brought $4,000, those upon fifteen acres brought $32,500, and those upon ten acres brought $38,000. The sales in a single week in Pennsylvania exceeded $300,000, and often the same tree was sold several times at advancing prices. A newspaper of the period said:

"Friday, the 'Alabama' took to Baltimore 22,000 mulberry switches, the value of which at the lowest calculation, based on actual sales throughout the country, cannot be less than $45,000. The number of eyes on these switches is ascertained by carefully counting them, to be 2,254,000, which would be considered cheap at 2 to 2½ cents a piece. The whole was raised on fifteen acres of land that would be considered well sold at $10 an acre in ordinary situations."

In 1839, just before the people came to their senses, a nurseryman sent an agent to France to purchase several millions of young trees. He carried $80,000 in cash as a first payment. When the trees arrived, the inevitable crash had come, and the nurseryman failed for so large an amount that he could never reckon up his indebtedness. His trees were offered in vain at a dollar a hundred for pea brush.

After the crash some large holders sought to unload without loss. They chartered an unseaworthy vessel, loaded her with trees and sent the cargo heavily insured via New Orleans to Indiana. To their great chagrin the vessel reached New Orleans safely and the trees were transferred to river boats at great expense and hurried on to their destination. When finally they arrived no one would take them as a gift.

When the fever was over and the people realized that their capital stock was suddenly worthless, a deep reaction set in. They pulled up all the mulberry trees in a rage and burned them as brushwood. The numerous companies which had invested their capital in them succumbed almost without exception. In 1841 only one survived and that perished four years later. In 1844 a violent storm following a general blight destroyed most of the remaining *Morus multicaulis* trees and even the more hardy white mulberry variety. This was the finishing blow and thus silk culture in America practically ceased to exist. No industry ever, in this country, received such a crushing stroke.

From that day to the present, sericulture has at times been spasmodically undertaken on a small scale in many States, but the total output has been almost infinitesimally small. The Secretary of Agriculture is now endeavoring to revive American sericulture by governmental aid.

RESTORATION OF THE PARTHENON.

Despite foreign criticism Greece is determined to restore the ancient Parthenon. At first the work was to be carried out with old fragments of marble taken from the surrounding earth, but the authorities finally decided that nothing but new, freshly quarried stone should be used. The result will probably be grotesque, for the ancient stone is weather-stained.

The original appearance of the old structure can probably never be restored. It has been quite definitely settled that although the edifice was built of the purest white marble, it was colored here and there. It is likely that the sculpture was also relieved by color and that the moldings were painted or gilded. The Greek government intends completely to restore the building merely so far as its original shape is concerned.

SCIENCE NOTES.

An oxyacetylene blow-pipe is described by M. Fouché in the Bulletin of the French Physical Society. The flame is formed by the combustion of a mixture of one part of acetylene to ¼ of oxygen, and in order that the explosion may not travel back into the blow-pipe, a jet velocity is required, due to the pressure of a water column four meters in height. The flame melts most metals readily; it will solder iron and steel. Even silica and lime are melted by it. With a reduction of the proportion of oxygen, the flame becomes luminous, and on falling on lime the free carbon goes to form carbide of lime.

J. O'Brien contributes a suggestive note to the Gardener's Chronicle, on the differing odor of *Odontoglossum hebraicum* as observed at different periods. When first flowered by the writer the blooms had a marked cinnamon odor, quite distinct from the hawthorn fragrance of other members of the group. On passing into other hands, the plant, when it first flowered, gave off the hawthorn odor but on the next occasion of its blooming the smell was that of cinnamon. The writer does not state if these differences of odor have been traced to diverse periods of the blooming. It has been noticed by those who grow the common jasmin that the flowers, when first expanded, possess in a marked degree the delicious fresh odor which is characteristic of them. But as flowering progresses, the perfume becomes less delicate, and the blooms are then very attractive to blue-bottle flies. This would appear to have some connection with the recorded formation of indol in the jasmin bloom as the process of flowering approaches completion.

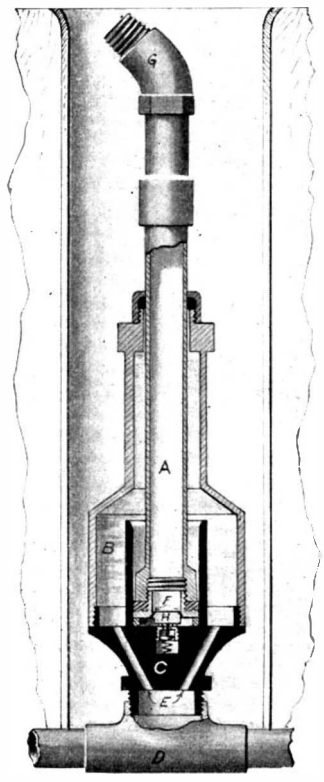
Mr. J. Halm, of the Royal Observatory of Edinburgh, has proposed a new and more complete theory of the sun, briefly as follows: Previous theories of the periodic changes have taken no account of the absorbing envelope surrounding the photosphere. If the loss of energy by radiation exceed the production of heat due to shrinkage, the temperature must fall. The level of the layer of maximum radiation, i. e., of the photosphere, must shift toward the center, and consequently the photosphere becomes protected by a greater thickness of absorbing and reflecting matter. After a time the increasing reflection may overheat the photosphere, but the overheated material may be retained at the level of the photosphere by convection currents until the upward tendency becomes so strong as to produce an eruption by which thermal equilibrium is temporarily restored, after which the cycle is repeated. The mathematical expression of the theory gives an equation from which a curve of sun spots may be computed which agrees very closely with the results of observation, while a "great period" of solar phenomena is accounted for by changes in the intensity of the convection currents, the equation showing that when the spot development is powerful the rise from minimum to maximum will be accelerated. A remarkable conclusion from the theory is that times of maximum spottedness correspond to times of minimum radiation, which would seem to be supported by the more important recent researches.

At the recent International Aeronautical Congress at Berlin Prof. Dr. Assmann, Director of the Aeronautical Observatory of the Prussian Meteorological Institute, described his registration balloon of caoutchouc or Para rubber, which was one of the novelties of the meeting. The ordinary *ballon-sonde*, made of silk or paper and open at the bottom, has the great disadvantage that, when it approaches equilibrium in the upper strata of the atmosphere, its velocity of ascent decreases and the effect of insolation on the thermograph becomes greater, without it being possible to determine afterward the place where the solar disturbance began during the ascent or where it disappeared during the descent; in fact, it is only in certain cases that we can distinguish between the insolation influence and the curious thermal anomalies that have been described by Teisserenc de Bort and Hergesell. The use of a closed balloon made of elastic material has this advantage, that in proportion as the inclosed gas expands, the ascensional force is increased so that the balloon rises faster with augmenting height until it bursts and then falls to the ground with diminishing velocity, because checked by a parachute. The time of equilibrium is therefore reduced to an instant, and although the higher the altitude the more intense is the solar radiation and its effect on the thermograph, yet the speed of ascent and descent is also increased and, consequently, the ventilation, which counteracts the radiation, is likewise stronger. The least possible weight of balloon envelope and of registering apparatus is required, for the lighter the whole apparatus, the less gas is needed, and the smaller the quantity of gas the more it can expand before the envelope bursts at a proportionally greater height.

© 1902 SCIENTIFIC AMERICAN, INC.

NON-FREEZING HYDRANT.

A hydrant embodying a number of important improvements is described in a patent recently granted to Mr. Charles L. Burkhart, of Dayton, Wash. The hydrant is provided with a tubular piston, which may be raised to permit the water to flow, and when lowered will stop this flow, at the same time opening a valve to drain out the water in the piston, thus rendering the hydrant non-freezing. The entire device is situated in a casing which is sunk into the ground. The tubular piston, which is marked *A* in our illustration, projects from the hydrant proper. The hydrant proper consists of two sections, *B* and *C*, which are screwed together and form a chamber. Section *B* has formed on its upper end a nut, above which is a packing fitted snugly against the piston, *A*. The section, *C*, is connected with the water-supply pipe, *D*. Two channels, *E*, lead up through the section, *C*, to the hydrant chamber. Projecting upward from the section, *C*, is a cylinder formed thereon, into which the lower end or head of the piston, *A*, rests when the hydrant is not in use. The piston head is provided with a rubber gasket, which snugly fits against the walls of this cylinder. The gasket is held in place by a cap piece, *H*. When in its lowest position the cap piece depresses the stem of a valve in section *C*, opening the valve and permitting all water in the piston to be drained out through an outlet channel. With the parts in the position illustrated, the pressure of the water in the hydrant chamber acts on the piston to hold the same in its lowest position. If it is desired to use the hydrant, the piston is raised until the piston head clears the top of the cylinder. The drainage valve then closes, and the water passes up through the openings in the cap piece, *H*, and out through the tubular piston. A hose may be connected to the elbow, *G*, and since the piston is revoluble, it will follow the movement of the hose, preventing kinking of the hose and consequent interruption in the flow of water. Since the piston must be lowered in order to cut off the flow of water, it normally assumes a position which will not interfere with a lawn mower. If it be desired to remove the hydrant from connection with the water supply without injuring the casing, it is simply necessary to remove the elbow, *G*, and slip a suitable tool down over the piston to an engagement with the nut on the upper portion of the section, *B*, and upon turning this the hydrant will be unscrewed from the coupling *D*.



NON-FREEZING HYDRANT.

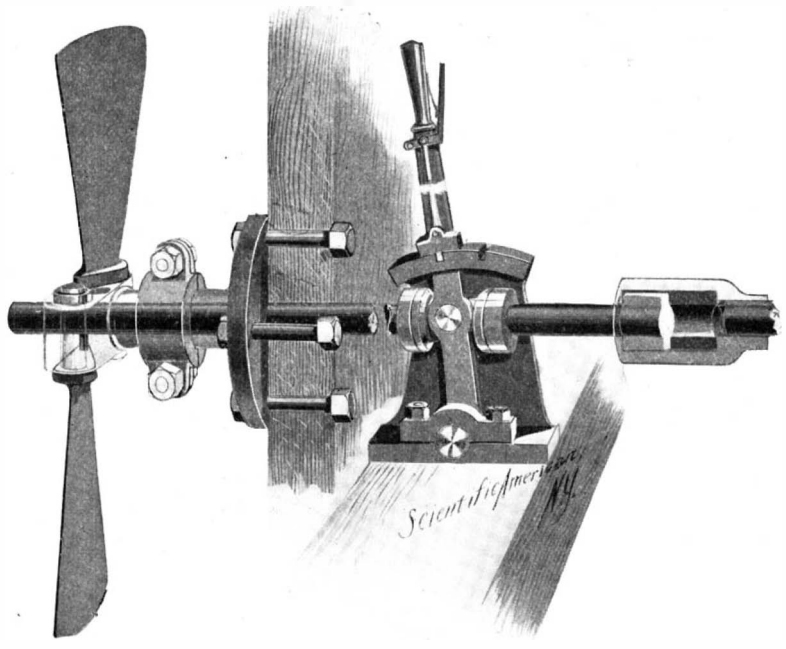
A few weeks ago the last train over the "baby gage"—a 22-inch railroad—was run from Longfellow to Metcalf, Ariz. Acording to the Copper Era, a new 36-inch narrow-gage road takes the place of the old. The "baby gage" was built in the early seventies. It was the first railroad ever built in Arizona. The engine was hauled overland from Sargent, Kans., then the nearest railroad station, to Clifton and set up by Dad Arbuckle, who is still in the employ of the company. At first the road was built and operated only to the Longfellow mine, but was afterward extended to Metcalf. The old "baby gage" was considered quite an engineering feat in its time, and justly, too, because it was built at a distance of more than one thousand miles from the nearest railroad points.

REVERSIBLE SCREW-PROPELLER.

The accompanying engraving illustrates a screw-propeller of a construction which enables it to be reversed by a sliding movement of the propeller shaft. It does not require the use of a hollow or tubular shaft usually employed, and therefore requires the use of only one stuffing box and other features incident to the two shafts. Further, it enables several reversible propellers to be mounted in tandem on the same shaft, thus securing great efficiency and at the same time preserving the advantage of reversible propellers.

The propeller shaft is connected at its inner end to the engine shaft by a coupling which allows longitudinal sliding movement. At its opposite end the propeller shaft passes through a box secured to the sternpost of the vessel. The propeller blades are carried on a hub mounted on the outer end of the propeller shaft. This hub is held against sliding movement with the shaft by a coupling which connects it with the box on the sternpost. This coupling, however, is of such design as to permit free rotary motion of the hub. Each blade of the propeller is provided with a crank-shaped base which is rockably mounted at one end on the hub, and at the other is held in place by a pin driven into the proper shaft and extending through slots formed in opposite sides of the hub. At a convenient point in the vessel a hand lever is mounted, which is suitably connected to the propeller shaft and may be actuated to slide the same longitudinally. Our illustration shows this shaft in its outer position. By drawing the shaft inwardly the propeller blades will be reversed, their crank-shaped bases, by reason of their connection with the pin on the propeller shaft, being swung on the pivot pins, which secure them to the hub.

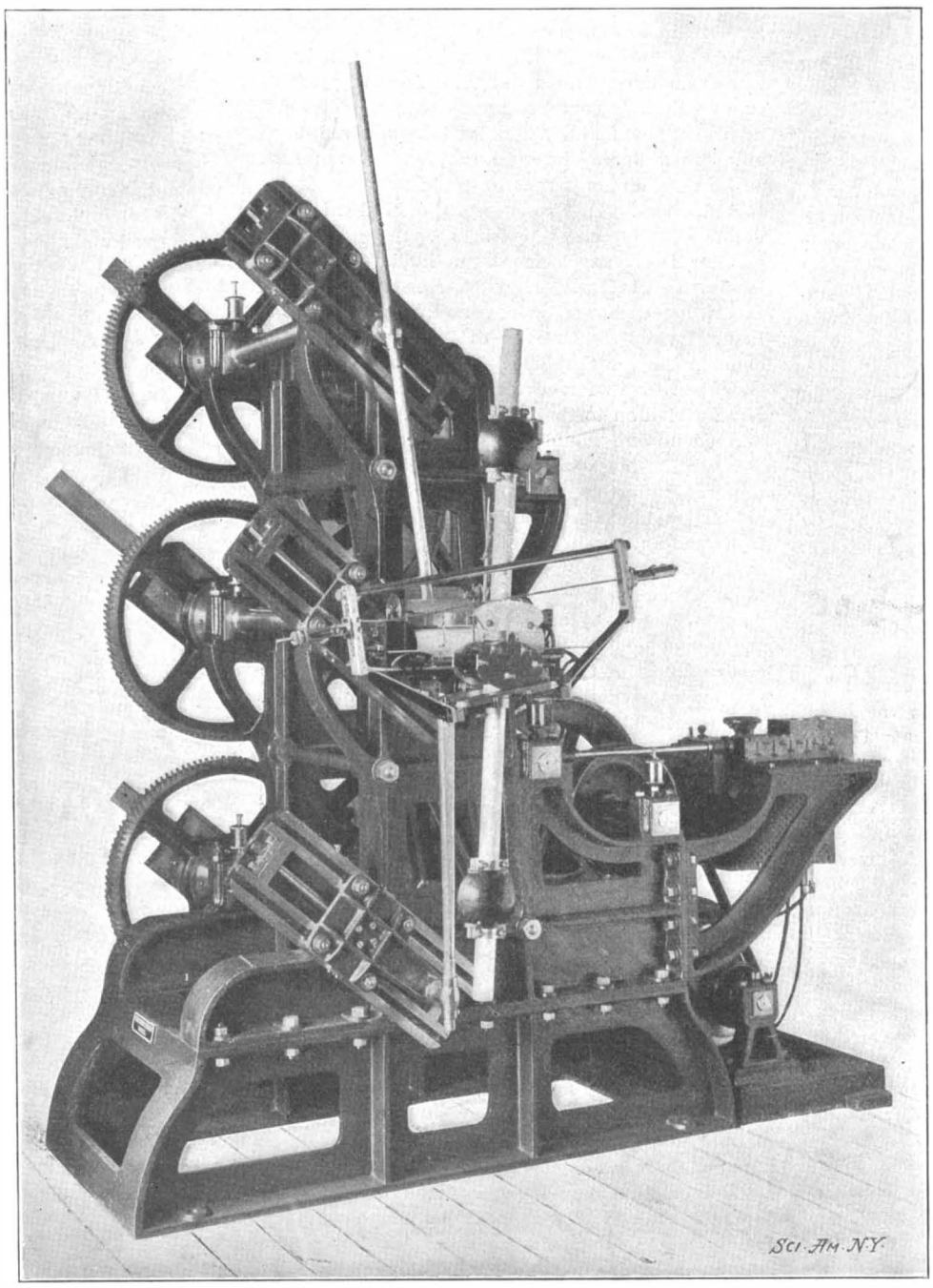
This invention will be found applicable particularly to small vessels, although of course it may be used on larger craft if desired. A patent on the device has recently been secured by Mr. Samuel Irwin, of Lindsay, Ontario, Canada.



REVERSIBLE SCREW-PROPELLER.

THE NAVIPENDULUM METHOD OF EXPERIMENT.

The movements of a ship in a body of still water are not unlike those of a pendulum, the ship, if it be moved from the perpendicular, beginning to oscillate around the vertical and coming to a state of rest after having gone through a series of oscillations of gradually decreasing amplitude. We present an illustration of an invention by Capt. Russo, of the Royal Italian Navy, which was designed to enable us to solve the problem of the rolling of ships. It will be seen that the apparatus contains a kind of pendulum which is composed of a heavy rod and two weights, one near each end. The pendulum rests and rocks through a central block upon a plate. The rocking motion of the pendulum is analogous to that of a rocking-chair or a small rocking-horse, to which the rolling motion of a ship may be roughly compared. In constructing a navipendulum, it is necessary to know certain data regarding the ship to be experimented upon, such as the displacement, form of hull, distribution of weights, metacentric height, the curve of stability, the period of oscillation, the amount of still-water oscillation, etc. All of these elements are involved, so that the instrument, if properly constructed, becomes an exact representative of the ship itself in everything that affects its rolling in still water. If the working of the navipendulum were confined, however, to still-water experiments, it would have but small practical value, as the beautiful tank experiments of the late Mr. Froude have given us all data on this subject. But the usefulness of the navipendulum begins where the tank leaves off, namely, in solving the important problem of the rolling of a ship on waves. After comparing the rolling of the ship in still water to the motion of a rocking-chair on a fixed plane, it is only necessary, in carrying the parallel further, to suppose that the sustaining plane, instead of remaining at rest, be made to oscillate, inclining and displacing itself from one side to the other in a forward and aft direction, and also in a vertical direction. The rocking-chair in this case, while following the plane of the various displacements, will, of course, have a more complicated movement than when the plane is at rest; it will incline from the vertical by angles of variable amplitude to the right and to the left. The oscillatory motion of the chair will, in such a case, be similar to the rolling of ships on waves, since it happens that the element on which the ship is supported continually changes in trim and position to the position of

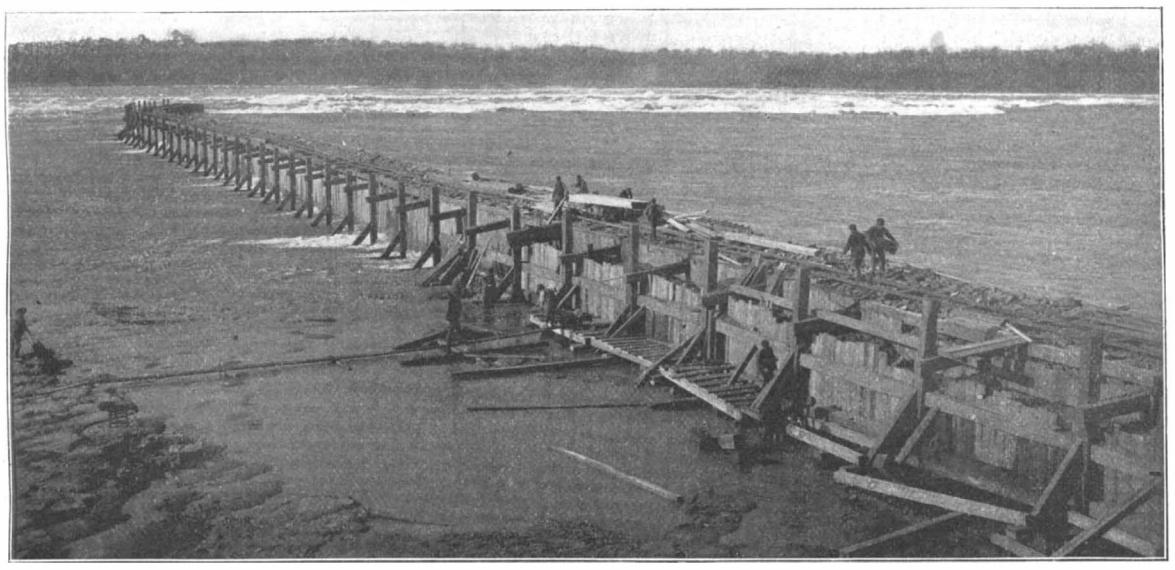


THE NAVIPENDULUM FOR DETERMINING THE STABILITY OF A SHIP AS AFFECTED BY WAVES.

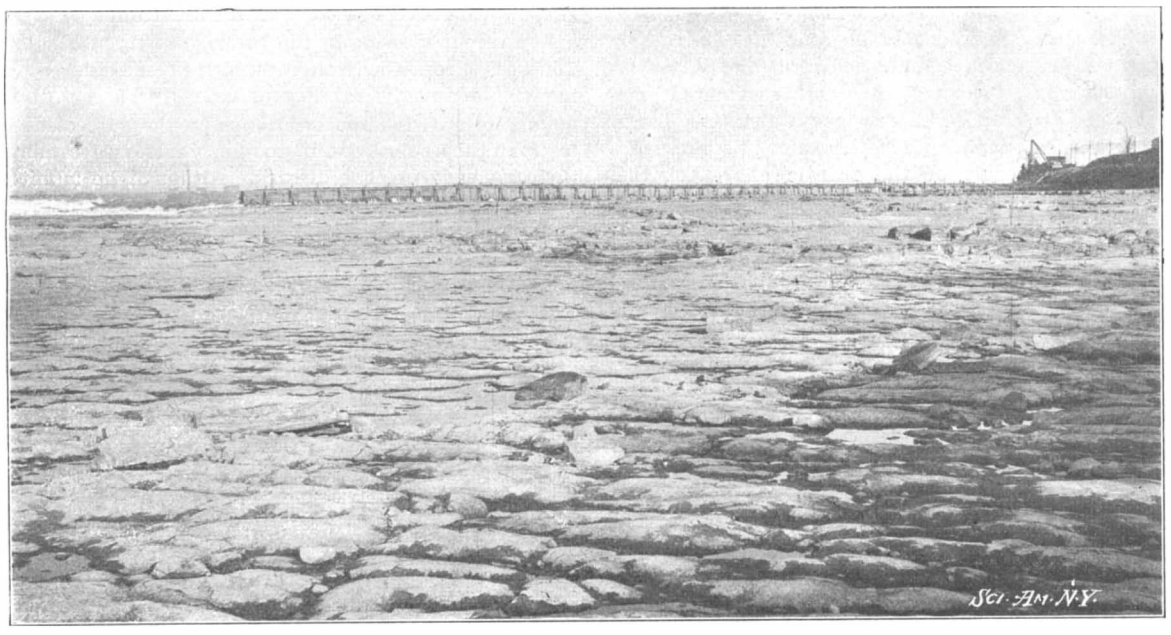
The bar with weights at each end rocks, by means of the rocker, at its center, on a plate, which changes its inclination in imitation of the changing inclination of the waves.

© 1902 SCIENTIFIC AMERICAN, INC.

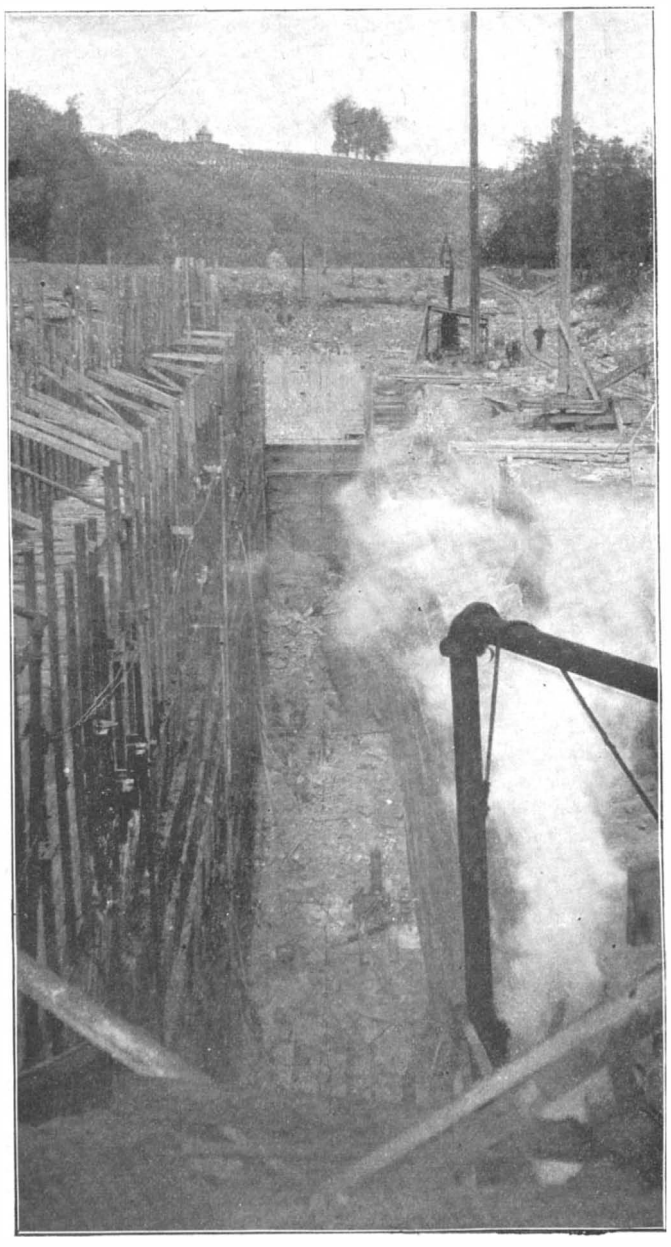
successive waves. While the above is but a rough comparison, the scientific process followed in Capt. Russo's method has led to the construction of an apparatus, in which it is claimed that a perfect similitude is established between the case of the ship in the waves of the sea and that of the navipendulum carried by the apparatus which we herewith illustrate. The whole object of the various axles, gears, electric motor, etc., is to give to the plate on which the navipendulum rolls a complex motion of a special nature, which is determined on the basis of the length, height and period of the wave constructed in the experiment. The navipendulum enables the naval architect to ascertain in the designing of a ship, the degree of steadiness which she will actually possess. Its importance in this respect may be judged from the fact that many ships have been found after construction to be wanting in a proper margin of stability. With the navipendulum to guide him the naval architect would never make any mistake on this question of stability. The apparatus described has been officially adopted by the Italian Admiralty, who have provided their experimental works at Spezia with an instrument of this kind.



OUTER END OF BIG WING DAM ABOVE THE DUFFERIN ISLANDS.



A LARGE SECTION OF BED OF NIAGARA RIVER ABOVE THE HORSESHOE FALL LAID BARE BY CONSTRUCTION OF DAM.



WHEELPIT OF THE CANADIAN NIAGARA POWER COMPANY.

THE NEW PLANT OF THE CANADIAN NIAGARA FALLS COMPANY.

BY ORRIN E. DUNLAP.

The Canadian Niagara Power Company is making good progress with its work on the Canadian side at Niagara Falls, and the time is fast approaching when this installation that is destined to command much attention will be completed. This company is practically the Niagara Falls Power Company, and the plan it has adopted for the development of power on the Canadian side is very similar to that so successfully established on the New York side, where a tunnel 7,436½ feet long and two wheelpits, one 424 feet long and the other 463 feet long, have been built.

On the Canadian side the scene of the power development is in Victoria Free Park, a section of territory purchased by the government for park purposes, in order that the beauty of the falls of Niagara might be preserved from vandalism and the works of man. Promoters of the industrial interests of the locality have, however, found that the park is an ideal site for a great power development, and the ideas thus developed are now being carried out in their fullest detail. The Canadian Niagara Power Company will develop power by means of a wheelpit and tunnel tailrace. The length of the wheelpit when completed will be 480 feet, but a section 266 feet in length is now being built. This pit will be 21 feet wide and 170 feet deep. It has reached a depth of about 115 feet at present. The method of construction, and the rock through which it is being sunk, are almost identical with that of the two pits on the New York side.

When completed the wheelpit will be lined with brick from top to bottom. The first section now building will afford a development of 50,000 horse power through the installation of five units of 10,000 horse power each. The contract for three of these has been awarded to Messrs. Escher, Wyss & Co., of Zurich, Switzerland, none of the shops in the Dominion of Canada having facilities for their construction. It is understood that they will be somewhat similar to the turbines installed by the Niagara Falls Power Company in wheelpit No. 2, but each of just twice the output capacity. The turbines just ordered are to be delivered within a year, and the first power from the installation is expected to be ready for delivery early in the spring of 1904.

The generators to be installed in the power station of the Canadian Niagara Power Company will also be of 10,000 horse power, or of twice the capacity of the generators in the two stations of the Niagara Falls Power Company. They will be wound for 12,000 volts, three-phase. The frequency will be 25 cycles, which will give uniformity with the plants on the New York side and allow of parallel operation. A generator that has an output capacity of 10,000 horse power will occupy but little additional space to a generator of 5,000 horse power, and while saving in space, the Canadian Niagara Power Company also secures a lower cost of generator per horse power and a lower cost of turbines per horse power. The speed of the generators will be 250 revolutions per minute. A feature of the development on the Canadain side is the fact that as the power plant will be located in Victoria Park, all of the power produced must, under the agreement with the commissioners, be transmitted beyond the park boundaries for use. Under these circumstances the voltage of 12,000 is expected to result in economy, and for long-distance transmission the voltage will be increased to 40,000 or 60,000. The power plants on the New York side will be connected with the Canadian plant by means of three cables strung across the upper steel arch bridge.

In connection with the development on the Canadian side the Canadian Niagara Power Company is constructing a large forebay. This will extend the full length of the wheelpit, but at a point where it will be bridged it will narrow down to 250 feet, passing which point it will again broaden out to 400 feet or more. The forebay will carry an average depth of 18 feet of water. From the north end of the wheelpit a canal 16 feet wide will be built for 500 feet to the river, affording facilities for an ice run. The flow in this canal will be regulated by gates. The bridge that will span the forebay will be of the stone arch type, built in five arches. It will have a width of 60 feet and will carry the tracks of the Niagara Falls Park and River Railway as well as a boulevard driveway. When finished the bridge will be one of the prettiest in the Niagara region.

The tunnel that will connect the wheelpit with the lower river will discharge very close to the foot of the Horseshoe Fall. It is 2,200 feet long, not a third of the length of the tunnel on the New York side. However, it is 25 feet high, which is four feet higher than the New York tunnel, and its width will be 18 feet. The tunnel has been driven, and the contractor, Anthony C. Douglass, is now removing the bottom bench, having taken out about 1,200 feet of it, or more than half. Owing to the great scarcity of brick, in lining this tunnel concrete is being used from the spring line down, but the concrete lining will have a facing of vitrified brick. This application of concrete will do away with 3,000,000 brick, but 1,250,000 brick will be used in forming the arch. Owing to the closeness of the portal to the Horseshoe, the masonry to be built there will be massive. As it is located at a point where ice gathers in immense quantities in the winter time, it will be subjected to great stress. This work will not be begun until next spring, owing to the nearness of the winter season. At the portal about 60 carloads of granite from Quebec and 200 carloads from Queenston will be used. In timbering the tunnel over 2,000,000 feet of lumber was used.

A SECOND GREAT POWER PROJECT.

The Ontario Power Company is also working on its project for the development of power in Victoria Park. This company's plan is to develop power on somewhat the same principle as that in use by the

© 1902 SCIENTIFIC AMERICAN, INC.

Niagara Falls Hydraulic Power and Manufacturing Company on the New York side. This latter company, however, carries its water to the edge of the high bank of the gorge through a surface canal, whereas the Ontario Power Company will conduct its water supply from the upper river, through the park, in large pipes, but whether they will be of wood or steel is not yet stated. The company will have its power station in the gorge, a short distance below the Horseshoe Fall, where a large force of men has been at work several weeks excavating the debris slope of the bank.

It is the Ontario Power Company that has constructed the immense wing dam out in the river above the Dufferin Islands. This wing dam is nearly 800 feet long, and already it has had the effect of diverting the waters of the river to such an extent, that a large area of the river bed between the dam and the Falls has been laid bare. The depth of water over this portion of the river was always inconsiderable, and the interference with the current by the dam easily produced the large area of dry river bottom shown in the accompanying photograph. It is interesting to note the curiously rounded appearance of the rocks resulting from the age-long attrition of the rushing waters.

THE MANUFACTURE OF TOYS AND DOLLS.

In a quarter of New York's "East Side," imbued with the half-European, half-American atmosphere so characteristic of Bohemian, Hungarian, and Polish settlements in America, a toy factory is situated which furnishes the children of our Eastern States with cheap, gayly-colored playthings. The factory, industrially considered, is a picturesque combination of modern labor-saving and old-fashioned labor-employing methods; for the most ingenious machinery and the simplest form of hand labor work side by side. There are some things that machinery can never do; and for that reason the factory girl cannot be dispensed with —in a toy-factory at least.

Historically considered, the toy industry may be said to have begun in Nuremberg. The development of the industry that made the old town so famous may be easily traced in the collections of the Germanic Museum. There completely furnished doll-houses, with cellars, vestibules, staircases, servants' quarters and drawing-rooms, are set up, and faithfully represent the home life of olden times. The old mechanical toys which are here to be seen are the work of locksmiths; for besides working at his trade the Nuremberg locksmith made many a clever toy. Tinkers opened a new field for the toy industry by the introduction of optical instruments, such as magic lanterns, and of magnetic toys, ships and swimming animals. The use of steam power and later of electricity gave the industry another impulse.

From roof to cellar the interior of the New York factory referred to is a chaos of flaring color. Paint—red paint, green paint, yellow paint, paint of all possible hues—is spread with lavish hand on the tin. The factory girls are besmeared with it; every floor reeks with it.

The tin used in making the toys is purchased in large sheets. By treadle-operated shearing machines fitted with reciprocating-knives the sheets are cut into strips or pieces of various sizes and shapes. Some of the sheets are embossed with designs, and are then passed through the paint-covered rollers of a painting machine, by which the embossed surface is coated and the intaglio left in its original bright metallic condition. These embossed and colored sheets are variously utilized in the making of kitchens, seashore-sand pails for boys and girls, shovels, comb cases and the like.

From the shearing-floor the cut sheets are taken to another floor to be stamped into various forms or "pressed," as it is technically called. The presses used comprise each a substantial frame with a horizontally mounted shaft connected by a crank with a plunger carrying a die. With but a single downward movement of the plunger a piece of metal is given any desired shape. Kitchen utensils such as cups, saucers, plates, dishes and the thousand and one articles that are made in a toy-factory are stamped out by these machines. Many of the products are taken to another room and turned in order to remove the jagged edges.

Besides the presses peculiar forming-machines are used which are of exceedingly simple construction, and which serve the purpose of forming tin tubes from long strips of metal, and of crimping the edges of various utensils. The tube-forming machines consist primarily of a table having a semi-cylindrical groove, and of a plunger carrying a die the length of the semi-cylindrical tube. By dextrously manipulating a long strip of tin, an operator causes the die to force the strip into the groove, in order to form a perfect cylindrical tube.

After the various articles have been made by the presses and forming machines, they must be painted. For that purpose they are turned over to girls who apply the color by brush. No machine could possibly perform this work; for the girl must know exactly where the color is to be applied and how to apply it. Almost every toy that is made must eventually pass through the hands of the painters. Railway cars are striped, kitchens are ornamented, horns are encircled with bright bands, and horses are given colored coats and furnished with painted harnesses. The painted toys are dried in a special steam-heated room.

Many of the toys either before or after they have been painted are turned over to men whose duty it is to rivet in their places parts which cannot be applied by machinery. Railway cars, for example, must be furnished with wheels. Certain workmen are therefore supplied with miniature axles upon which a single wheel is rigidly secured at one end. The axle is clamped in a vise; the car bearings are slipped over the axle, and the remaining wheel placed in position and riveted with a few taps of the hammer. Similarly, horns must be furnished with sound-producing means. For that purpose solderers are employed, who are furnished with small brass reeds, which are leaded in place at the mouth-end of the horn and covered with wooden mouthpieces. The horns after having been equipped with their reeds are tested. If the reed has been improperly applied, the error is corrected. Some of the toys, as for example human figures, must be dressed, and are therefore passed to girls, who sew the garments on the tin bodies.

Mechanical toys, which, at one time, were almost exclusively made in Germany, are also produced in this New York factory, though in limited quantities, to be sure. Many of these toys are ingenious pieces of mechanism and comprise interesting mechanical movements. Without exception the mechanical toys are all driven by clock-trains, the escapement of which is so mounted as to produce the peculiar effect desired. By an ingenious arrangement of the escapement and the clock-train, miniature drunkards are produced, with reeling walk, maudlin nodding head, and absurdly moving arms, which simulate an attempt to fill a glass held in the one hand from a bottle held in the other. A fiddler who industrially saws away, without, however, producing any sounds, is another interesting mechanical toy. But perhaps the funniest of all these mechanical playthings is the so-called "balking mule," which represents a clown seated in a cart drawn by a rather refractory mule whom he seeks to control by rocking himself forward and backward, and violently jerking the reins. The toy is so constructed that the mule gallops forward for a few paces and then backward with equal rapidity for the same distance—all apparently the result of the frantic efforts of the clown to stop him.

In another New York factory situated in the heart of the business district, dolls are made; not China dolls, but dolls that can be dropped upon the floor without breaking. The process of manufacture on the whole is decidedly simpler than that of making metallic toys. The steps are few and simple. A peculiar composition is poured hot into a mold to form the head, arms, or feet. After the portion thus cast has cooled, it is removed from the mold and passed on to workmen, who pare off the seams and jagged edges by means of knives and smooth the surface with sandpaper. The eyes, which are specially imported from Europe, are then inserted through the neck into the sockets. Other operators thereupon paint in the eyebrows and hair and tint the cheeks. The more expensive dolls are provided, not with painted hair, but either with artificial hair of jute or with real hair.

The bodies of the dolls are merely stuffed sacks with extensions upon which the arms and legs can be sewed. After the entire doll has been completed, it is dressed in clothes varying in splendor with the price of the doll.

The Need of a Safe Match—A Chance for Inventors.

At a meeting of about forty manufacturers and dealers, called at the suggestion of the Fire Commissioner of New York, to consider the possibility of finding a match that would be safe to use, it was stated that the safety match is in reality no safer than the parlor match. If this be true, there is not much to be gained by the law prohibiting the sale of parlor matches. There seems to be here a chance for some inventor of a chemical turn of mind to use his ingenuity in designing a match which shall be safer than the matches at present in use, and shall not entail any danger in its manufacture.

Award of the Nobel Prizes.

The Nobel research prize of $40,000 has been awarded to Major Donald Ross, of the Liverpool School of Tropical Medicine, in recognition of his investigations into the mosquito-malaria theory. Three other Nobel prizes were awarded, as follows: Natural science and chemistry, Dr. Emil Fischer of the Berlin University; physics, Dr. Arrhenius of the Stockholm High School; medicine, Dr. Finsen. Each prize is worth 160,000 marks.

Correspondence.

The Effect of Light on Animal and Plant Life.

To the Editor of the Scientific American:

I note with interest a very able article in your last issue, by Dr. James Weir, Jr., in which he describes the effect of light on plant and animal life, with but one probable error, which I shall endeavor to point out. He says among other things:

"Flammarion's beautiful experiments at the climatological station at Juvisy have shown beyond question of doubt the widely different effects of the red and violet rays on plants. The plants chosen were of the genus Mimosa, or "sensitive plant," and were subjected to the same environments with the exception that some were reared beneath dark blue glass, and others beneath red glass.

"In four months the plants grown under the red glass had attained extraordinary development, while those subjected to the violet rays had made no progress whatever. Similar effects were noted in the case of strawberries, and numerous other plants, vines and shrubs.

"The plants grown beneath blue glass did not die, but seemed to remain in a dormant condition, without growth or further development. Zacharawietz, of Vaucluse, has also shown that plants are strongly affected along the lines of rapid growth and development by red and orange rays. As early as 1883 I demonstrated and published the fact that typhoid fever germs would not live when subjected to the blue or violet rays."

From the foregoing one gets the impression that plants under a red glass are subjected to red rays of light, while the reverse must be true, as the red glass has absorbed all the red rays of light, and the remainder only have penetrated.

Who has not observed that in a photographic dark room, where a red light is used, anything therein which is red will appear white, for there are no red rays in the room, all being absorbed by the red paper through which the light is filtered.

E. Ritchison.

Modale, Iowa, November 22, 1902.

Koch's Last Communication.

At a recent meeting of the International Tuberculosis Congress, Prof. Koch reiterated all that he said regarding the non-transferability of animal tuberculosis to man. He asserted that statistics on the subject of intestinal tuberculosis were too incomplete to establish the frequency of that disease. Although he admitted that cases of tuberculosis do occur among butchers and other persons who handle animals, he asserted that the percentage of sufferers from the disease among joiners is equally as high as among handlers of animals and meat. Experts state that large amounts of tuberculous meats are consumed, and that not only the flesh, but even the tuberculous organs are made use of for food, yet no widespread infection follows. Prof. Koch declared that only two cases of alleged general infection were known to him, and that these two were not proved.

Shipment of the 16-inch Rifled Gun.

The 16-inch rifled gun built at Watervliet for the United States Government, has been shipped to Sandy Hook. The railroad companies feared to transmit the 130-ton gun over their roads and refused transportation, by reason of the great strain which it would impose upon their bridges. A New York dredging company made a contract with the company to transfer the weapon from Watervliet down the Hudson River from Troy to Sandy Hook. The price for this service is said to have been $5,400. The gun was placed on a specially-built car and run to the river front. There the gun and car were lifted onto a barge by means of a 250-ton derrick. At Sandy Hook the wharf was strengthened to receive the big gun.

The Current Supplement.

In the current Supplement, No. 1405, the description of the Langley aerodrome is concluded. Certain improvements in methods of quarrying slate are published, which are well illustrated. Francis J. Fitz-Gerald discusses exhaustively the subject of the conversion of amorphous carbon into graphite. An article on long spans for overhead electric cables is a subject which, at a time when the transmission of electrical currents over long distances is being more and more developed, should be read with some little interest. Mr. Kittredge concludes his discussion of the utilization of wastes and by-products in manufactures. Prof. Dr. von Bezold tells much that is interesting of the upper atmosphere. Archæologists will find published for their special benefit an account of the recent discoveries of the Italian mission in Crete, and an article by Eduard Seler on Prehistoric Civilization in America. V. de Turine describes photophonic books for the blind. The usual number of Selected Formulæ, Consular Notes and Trade Notes are also published.

© 1902 SCIENTIFIC AMERICAN, INC.

Exposition of Hygienic Milk Supply.

The U. S. Department of Agriculture has received through the Department of State notice that a general exposition of hygienic milk supply will be held at Hamburg from May 2 to May 10, 1903. The exposition will embrace eight sections as follows:

Section A.—For milk production: (1) Exhibit of limited number of milch cows of known race; (2) stable fittings and implements; (3) regimen and hygienic food; (4) technics of milk, tests, and execution of; (5) management of milk in stable and pastures; (6) personnel of milking and stable (clothing, health and supervision of the same).

Section B.—Veterinary control of the condition of milch cows and of milk: (1) Legislation; (2) management of contagious outbreaks (with demonstration); (3) diseases of milch cows; (4) special diseases; (5) unwholesome food plants and drinking water; (6) secretion through the milk of medicinal stuffs; (7) sanitary management; (8) disinfection of stalls (means and apparatus).

Section C.—Conveyance of milk, land and waterways, railways; conveyance and distribution in cities; (2) cleansing, spinning, cooling, Pasteurizing, sterilizing and concentrating (condensing) milk; (3) arrangements for measuring and weighing; (4) cleansing apparatus for flasks; (5) machinery for bottling, pouring and sealing.

Section D.—Exhibit of management and sale of milk (wholesale and retail trade), with complete furnishings.

Section E.—Milk legislation and administration: (1) Laws, ordinances, decrees and judgments; (2) police supervision of milk traffic (removal, previous examination, preserving, conveyance); (3) chemical and bacteriological inspection; (a) model laboratory, working; (b) instruments and tools for laboratory.

Section F.—Scientific: (1) Means of instruction with scientific demonstration; (2) scientific instruments and tools for milk laboratories; (3) literature, statistic and graphic exhibitions.

Section G.—Milk preparations: (1) Condensed and prepared for long keeping for use in the army and navy; (2) milk for infants; (3) for therapeutic purposes; (4) other foods and preparations produced from milk.

Section H.—Machinery and apparatus for the treatment of milk in the household.

Intending exhibitors should make application for space to the Geschäftstelle in Hamburg, 6, Kamp Strasse 46.

"The Land of Unbounded Possibilities"—A German Economist's View of the United States.

Herr Ludwig Max Goldberger, of Berlin, Royal Privy Councilor of Commerce and Member of the Imperial German Consultative Board for Commercial Measures, recently made an eight months' official tour of the United States for the purpose of observing the industrial developments in this country from a commercial and economic standpoint. His articles were contributed to the German weekly, Die Woche, under the general title, "The Land of Unbounded Possibilities," from which the following are extracts:

"The United States, like an enchanted garden, has brought forth from a marvelously productive soil splendid results of human ingenuity. Yet the thing that causes most wonder is that the concentrated intelligence which, intending to replace human factors by machinery, has, in working toward its aim, been giving to constantly growing numbers of workmen an opportunity to support themselves and become productive factors. The joy at the size of their own land encourages each individual. It makes him communicative and friendly to foreigners who are seeking information. It seems as though everyone were filled with the idea, 'The stranger shall see how great and strong America is.' My eight months' trip of observation and study took me through the States, and everywhere I found open doors inviting me to enter, and nowhere did I find the slightest attempt at secretiveness. Everywhere I observed an uncommon but steady bustle of men who enjoy their work and are consciously working for great results. 'It is a great country.' This is the verbatim designation of reverential admiration which the citizen of the United States has found for his country.

"The inhabitants of the United States, including Porto Rico, Hawaii and the Philippine Islands, number about 88 millions—that is, barely 5 per cent of the world's total inhabitants, according to its highest estimate. This 5 per cent has at present taken possession of 25 per cent of all the cultivated area of the earth, viz., 407.4 million acres out of 1629.3 million acres. A land of marvelous fertility offered itself for tillage, and the husbandman had but to gather in the produce. The virgin soil made his work easier, and its extensiveness rendered the application of artificial fertilizers practically unnecessary, although the agricultural offices of the States and the Union have constantly by excellent advice and practical expert assistance been furnishing the ways and means toward more intense cultivation.

"Let us examine the corn crops for the six years, 1895-1900. The world's total product fluctuated between 2.6 and 3 billion bushels per annum, a total of 16.6 billions for the period with an annual average of 2.77 billions. Of this amount the United States alone produced 12.4 billions, an average of 2.07 billion bushels per annum, or 75 per cent of the world's crop.

"Toward the world's wheat crop the United States contributed in the five years 1896-1900, 20.7 per cent, while for the year 1901 its contribution to the world's production of wheat amounted to 25 per cent. During the years 1896-1900 there were grown 14.7 billion bushels of oats in the world, and of this 3.74 billion bushels, or 25.5 per cent, were produced by the United States.

"In the production of iron ore the United States proved itself to be a veritable land of unbounded possibilities. It produced very nearly 36 per cent of the total iron ore produced, and that of the very best quality. In the past year the United States produced 39.3 per cent of the world's product of pig iron. In 1900 it produced roughly 10.1 million tons of steel, or 42 per cent of the world's product, and in the year 1901 the United States output was increased to 13.5 million tons.

"The United States produces nearly 55 per cent of all the world's copper. The development of the American copper industry was perhaps more rapid than typical for even American changes. From modest beginnings this industry grew by leaps and bounds in a remarkably short time to the most important factor in the world's production. In 1870 the copper production of the United States amounted to 12,000 tons; in 1880 its production had increased to 27,000 tons out of a total world production of 153,000 tons; in 1890 the United States produced 116,315 tons of the world's product of 269,455 tons. During 1895 it controlled more than one-half of the world's production, and at the end of the century the United States produced 270,000 tons, or more than the world's entire product had amounted to ten years before.

"The output of lead in the United States since 1895 has increased to such an extent that it has wrested from Spain the position of primacy in the world's production. In 1900 the United States produced 29.6 per cent, while Spain's share had receded to 18.7 per cent. In 1901 the United States increased its production of lead to 250,000 tons.

"The rivalry of the United States in the production of quicksilver has been equally strenuous. In 1900 for the first time Spain's product is slightly exceeded by that of the United States. In 1901 Spain's share in the world's product amounts to but 28 per cent, while the United States furnishes 33 per cent of the world's total product.

"The total world's production of gold for the year 1900 was estimated to be 255.6 million dollars; that of silver represented a coinage value of 223.5 million dollars. For the year 1901 estimates for both metals amount to 265 million dollars. In each of the two years the United States showed the greatest share of both metals, 31 per cent for gold and 33 per cent for silver."

Prof. Trowbridge's Experiments with Gases Subjected to Very High Temperatures.

In a communication to the Electrical Review, Prof. Trowbridge states that his study of gases produced by powerful discharges from condensers charged by a storage battery of from 10,000 to 20,000 cells, has now reached its limit. The glass vessels containing the gases volatilized under the effect of the discharges, and after one or two discharges cracked under the effect of the great heat. During the past summer he obtained in London suitable vessels made of quartz, which can be heated to a white heat without cracking, even if, while at this heat, they are plunged into cold water.

For this purpose Geissler tubes were made—four or five inches long—with a capillary portion of two inches in length.

In this capillary part the electric discharges produce the most intense light that has ever been studied, Prof. Trowbridge believes, in a laboratory. In its photographic effect it is at least four times that produced by the same amount of electrical energy discharged between magnesium terminals.

The result of Prof. Trowbridge's study of this light reveals the presence of both bright and dark lines in the ultra-violet portion in the spectrum of hydrogen or water vapor. The dark lines have never been seen before. They are due to a selective reversibility or selective solarization of the lines of the gas.

An American tender to install underground telephones in the city of St. Petersburg for 315,000 rubles has been accepted. The tender was on lower terms and easier conditions of payments than the offers of other bidders for the work.

Electrical Notes.

The Sheffield, England, electrical engineer, Mr. S. E. Fedden, gives some interesting figures relating to the use of steam turbines for electrical power generation in a paper read recently before the Municipal Electrical Association. From a table of actual tests of a 500-kilowatt turbo-alternator running at 2,500 revolutions per minute and with 140 pounds steam pressure at the stop valve, it appears that the consumption of steam per kilowatt hour at full load varied between 22.2 pounds to 28.9 pounds. The former consumption was obtained with a vacuum of 28 inches and the latter with 22 inches in the condenser. An economy of 8 per cent in steam consumption was obtained with 50 deg. superheat and 12 per cent with 100 deg. superheat.

Interesting experiments have been conducted by Dr. Lemstrom of Helsingfors University on the effect of an electrical discharge on the growth of plants. Four seeds of barley, wheat and rye were sown in pots, the soil being electrically connected with the ground. Above the two pots was suspended an insulated network of wire with a number of points of a Holz machine so connected that in some of the pots the electric current passed from the metal work to the earth, while in others it passed in the reverse direction. For five hours daily a current was passed through the soil. After eight weeks the height of the plants affected by the electric current was found to be about forty per cent greater than those to which no current had been applied. It is said that experiments with other plants show similar results, but different in degree.

The option held by the Continental Trust Company to purchase the common stock of the United Electric Light and Power Company and the stocks and bonds of the Mount Washington Electric Light and Power Company was exercised on November 15. The syndicate will secure power from the Susquehanna River. The introduction of electric power derived from the force of the Susquehanna River will have a vast influence on the manufactures of Baltimore. It is estimated that the cost of lighting the city can be reduced to about $20 per year per lamp, if the city maintains its own distributing plants. It now costs the city $99.12 for each arc lamp under a contract which expires in September, 1905. It is hoped that the industrial growth which accompanied the introduction of electric power at Niagara Falls will find a parallel at Baltimore. Plants of 50,000 gross horse power are planned.

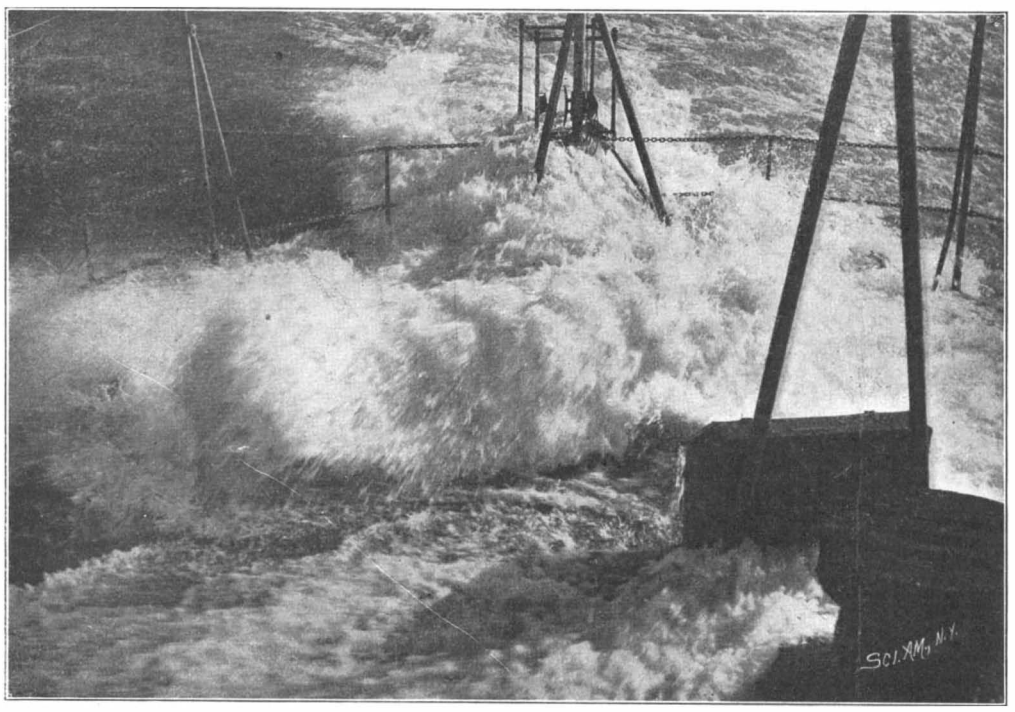
Rear-Admiral R. B. Bradford, Chief of the Naval Bureau of Equipment, has recommended to the Secretary of the Navy that the government secure control of all wireless telegraphic stations on the coast of the United States. Unless this is done, Admiral Bradford believes that there will be interference in the transmission of wireless messages between stations of private companies within the same circuit. Foreign governments are exercising careful supervision over the location of wireless stations for strategic reasons. Admiral Bradford in his report states that he had not been able to arrive at any satisfactory conclusion with the Marconi Wireless Telegraphy Company, for the reason that he can obtain instruments only on the payment of royalty. He states that most naval powers are far in advance of the United States in the installation of wireless telegraphic appliances on board naval ships, but he believes that no ground has been lost by reason of the slow progress made.

A new process for making incandescent lamp filaments has been invented by M. de Marc, of Brussels. His object is to form a core of magnesia upon which is deposited a layer of carbon, thus giving a filament which has a greater mechanical resistance than the ordinary carbon filament. To obtain the core, a mixture of magnesia, tar and powdered carbon is made and the pasty material is formed by high pressure into filaments or bands of the proper diameter. The filaments are then heated in a gas furnace at a high temperature in order to solidify them and produce a partial combustion. After coming from the furnace the filaments are very hard and resistant. They are then placed in a chamber in rarefied air or a gas containing oxygen and a weak current is sent through them in order to produce a combustion of the carbon and leave only the magnesia which forms the base of the core. In fact the carbon begins to burn at the exterior and the combustion proceeds toward the interior of the filament, while on the surface is formed a solid layer of magnesia. After this preliminary treatment they are burned in free air until all the carbon is consumed. In this way a small tube of pure magnesia is obtained, which is then to be coated with carbon to form the lamp filament. For this it is treated by a flash process like that of a carbon filament, in an atmosphere of hydrocarbon gas and the filament when raised to incandescence receives a deposit of carbon on the surface. Thus prepared, they are mounted in a bulb to form the lamp. The inventor claims that the lamps formed according to this process have a great mechanical resistance.

© 1902 SCIENTIFIC AMERICAN, INC.

THE NEW MONITOR "WYOMING."

The monitor "Wyoming," herewith illustrated, is one of the four monitors ordered by the government in 1898. The "Arkansas," "Nevada" and "Florida," now building in eastern yards, are identical. Their dimensions are, length on water line, 252 feet; extreme breadth, 50 feet; displacement on draft of 12 feet 6 inches, 3,218 tons. Watertight bulkheads, electric lighting and other conveniences for officers and crew are provided in as perfect detail as on ships of five times the tonnage.



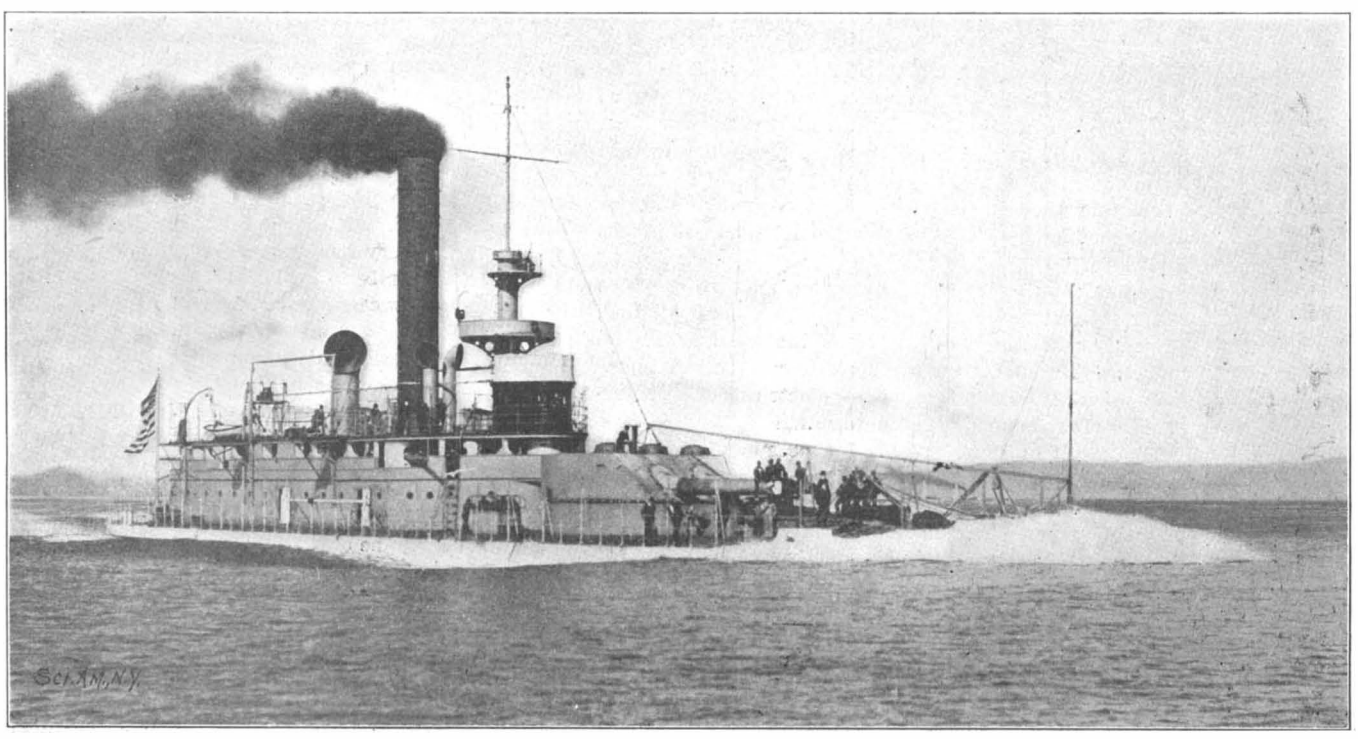
TAKING IT OVER THE STERN AT 11.8 KNOTS.

The armament of the "Wyoming" is heavy for a vessel of her size and class. It consists of two 12-inch breech-loading rifles, four 4-inch, three 6-pounders, six 1-pounders on the main deck with two of the same caliber in the fighting top. Forward is the armored turret protecting the 12-inch rifles. The hull is protected by steel armor, which for 108 feet amidships is 11 inches thick, diminishing to 5 inches at armor shelf, The belt extends from 2 feet 6 inches above the water to the same distance below, gradually tapering in thickness from 7 inches (just beyond the 11-inch belt) to 5 inches at both extremities. The engines are triple expansion, with cylinders 17, 26¼ and 40 inches respectively in diameter, with stroke of 24 inches. At 200 revolutions the engines develop 2,400 horse power.

There are four Babcock and Wilcox boilers with an aggregate heating surface of 8,800 feet and grate surface of 200 feet. A pressure of 250 pounds is developed at forced draft. Vessels of the "Wyoming" class are for purely defensive purposes.

The accompanying photographs, which are some of the most striking of their kind ever taken, were made on board the "Wyoming" when she was undergoing her trials, and they give a very impressive idea of the difficulties which a gunner on one of these monitors labors under when he endeavors to lay a 12-inch gun if the vessel is pitching or rolling in a heavy sea. Although the sea that was running on the occasion of her trials could not be called heavy for a vessel of the ordinary type, with a freeboard of say from 14 to 21 feet, it is evident that the monitor "Wyoming" made pretty rough work of it. At the bow there was a mass of broken water, and solid sea boiled up on deck, while spray was thrown high into the air. For the end-on position in which these vessels would prefer to do most of their fighting, there would be probabilities of poor marksmanship with showers of spray and broken water and the tops of the adjoining waves interfering very seriously with the gunner's aim. A heavy sea followed in the wake of the vessel, curling over and breaking inboard. Another feature that prevents good marksmanship on a monitor is the fact that her shallow depth and great beam render her very quick in her rolling and pitching movements. However, these monitors are intended for harbor defense, where the probability of heavy weather is somewhat remote. The pair of 12-inch guns which constitute their main armament are about the most powerful weapons of their class afloat. They are capable of penetrating nearly 20 inches of Krupp steel at a distance of 3,000 yards. Hence, as floating batteries co-operating with a system of land defenses, these vessels would find a limited sphere of usefulness; and it is not likely, under the present conditions of warfare, that they will ever be called upon for deep-sea work.

BOW OF THE "WYOMING" AT 11.8 KNOTS.



MONITOR "WYOMING" DOING 12.37 KNOTS ON THE MEASURED MILE.

Gas Arcs.

A number of years ago Denayrouze endeavored to obtain a higher flame temperature inside the mantle by blowing the required amount of air into the burner.

According to the Progressive Age, it was realized that the maximum temperature could not be obtained inside the mantle unless there was enough air thoroughly mixed with the gas to obtain complete combustion. The ordinary Bunsen burner did not and does not now draw in enough air for complete combustion and this makes it necessary to employ special devices when high efficiency is desired. The Bandsept construction has not been adopted in this country, but the Kern burner, which is a development along the same line, is now in satisfactory use among our gas consumers, and depends upon superior design and construction for its high efficiency, chimneys being dispensed with in the domestic installations. These burners seem to have gone as far as design alone in the injector and mixer construction can go. The Denayrouze idea of adding air under pressure possesses the disadvantage of requiring auxiliary apparatus which must also be maintained, thus limiting the field of application very much, although the English tests of the Suggs and Keith apparatus do not by any means point to failure.

In Germany there was another idea conceived, and the product put on the market during 1899 and 1900, which obtained the desired result by connecting the small globe surrounding the mantle to a tall chimney above it, which produced sufficient draft to suck the consumed gases rapidly through the mantle, and so much reduced the pressure inside it as to create an increased upward draft of air through the Bunsen tube. The quantity of gas passing through the jet depended upon its size and the gas pressure and was very little influenced by the increased suction in the Bunsen tube, so that the desired increase in the proportion of air was obtained, a high degree of temperature produced and the resulting incandescence far exceeded that of ordinary burners. This was further increased by permitting the gas to become heated before entering the burner.

This design is known as the Lucas lamp and to the inventor is due the credit of providing the gas industry with a means of displacing electric arc lamps, for our popular gas arcs are the outgrowth of the Lucas principle.

A Curious Accident.

A curious accident befell an electric street railroad car in the north of England recently during a thunderstorm. At the terminus a car was waiting to begin a journey, and several passengers had taken their seats both inside and on the outside of the car. There came a vivid flash of lightning, followed immediately by a terrific report on the car, and the whole interior of the vehicle seemed to be ablaze. When the flame had vanished the car was filled with smoke. The lightning had struck some trees, the branches of which overhung the stationary car so that they conducted the lightning current to the vehicle, and upon coming in contact with the current propelling the car, fused. Fortunately no damage was caused beyond the fusing, though the vehicle might have been set ablaze.

© 1902 SCIENTIFIC AMERICAN, INC.

GUATEMALA'S EARTHQUAKES.

BY THOMAS R. DAWLEY, JR.

Guatemala has been particularly disturbed by earthquakes during the present year. Just about the time the world was horrified with the news of the eruption of Mont Pelée and the wiping out of the city of St. Pierre with its thirty thousand inhabitants, and also that of Soufrière, which caused great destruction and loss of life on the adjacent island of St. Vincent, news came from the Central American republic that its second largest city, Quezaltenango, had been entirely destroyed by earthquakes; but this third terrible catastrophe was lost sight of in view of the harrowing details of those so much nearer to us in the West Indies, and available to the news gatherers. The available means of transit shut us off from that most interesting country which has been the center of seismic disturbances throughout the present year, and it is only after a lapse of time that we can obtain anything but the most meager reports of what has really happened.

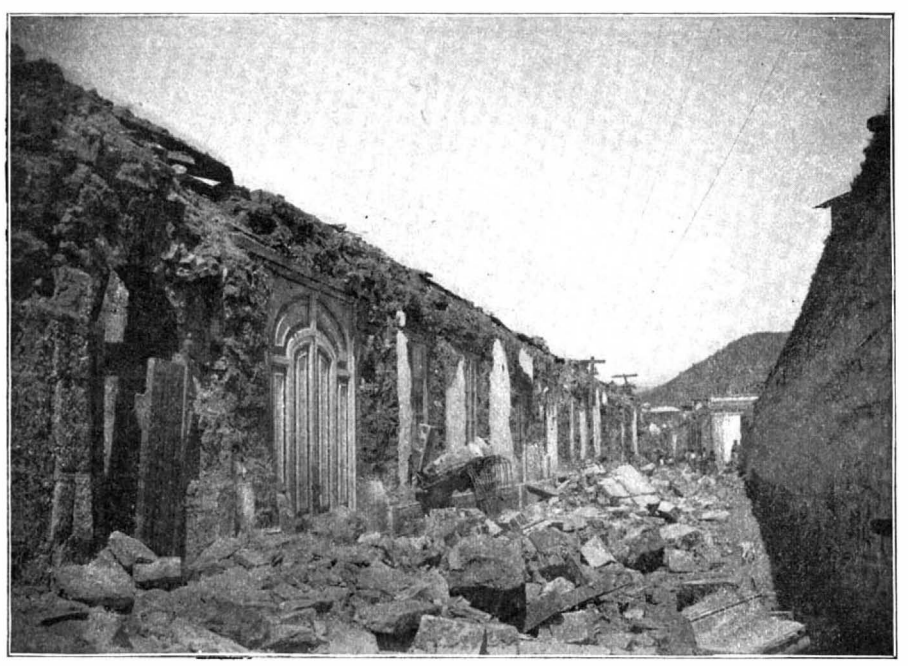
Quezaltenango was a well-constructed city of imposing edifices of limestone, containing a population of upward of thirty thousand souls. It is supposed by some to have been built in the crater of an extinct volcano, but this is doubtful, the belief having originated from the fact that it is surrounded by high, jagged mountain peaks at an elevation of 8,000 feet above the sea. The earthquakes which destroyed it occurred last April, and shook the city from its very foundations, toppling the walls of the houses into the streets, killing and maiming many of its inhabitants.

The major portion of the population of the city were Indians, but these are not Indians in our sense of the word, whom we most invariably picture as a wild, roving band of barbaric or semi-civilized people. The Indians of Guatemala maintained at the time of their conquest a civilization much superior to that of the Aztecs of Mexico, but they were lacking in both political and military organization sufficient to hold them together in any decided opposition to the small army of Spaniards under Alvarado, which Cortez sent against them, although they made on many occasions heroic resistance to their conquests. Though nominally conquered, many of them have preserved their ancient civilization and language intact to this day, the Nahuilas presenting the most striking example of this. These number about thirty thousand souls living in a gigantic caldron scooped out of the mountains, as it were, in the midst of the Cordillera, between the capital and Quezaltenango. They met Alvarado's army outside of their rocky basin and give it battle for an entire day, after which both they and the Spaniards appear to have been willing to treat for peace, and terms were agreed upon by which the Nahuilas promised to recognize the Spanish sovereign, the Spaniards on their part agreeing to leave the Indians alone in the future. And they have been pretty well left alone. They do not allow any stranger from the outside world to reside in their principal city, Santa Catalina, which is at the bottom of the bowl-like country, and they look with suspicion upon any one passing through their domain. They govern themselves, although the Guatemalan government pretends to exercise jurisdiction over them. They do not intermarry with any of the people surrounding them, and should one of their women fall a victim to the intrigues of an outsider, the offspring is sacrificed and the mother becomes an outcast. In former days, it is said that she was killed as well as the child. They allow no rum nor intoxicants of any kind sold within their jurisdiction; have no use for a jail, but flog those who are guilty of any crime known among them, such as a man and wife being unable to live together without quarreling, which is one of their most serious offenses. For these privileges of self-government they pay the government of the republic an annual tribute of $30,000

Guatemala has an estimated population of more than a million and a half people, and a climate so diversified that its people can find a home in any climate they choose, ranging from the tropic to the frigid zone. There are scattered hamlets on the coasts bathed in the burning rays of a tropical sun, where the land is so fertile it scarcely requires any effort on the part of the sparse population to produce their daily requirements. There are stretches of sandy plains, on the other hand, where it is necessary to turn the rivers from their beds to irrigate and produce, while higher up in the interior the traveler may find himself in a fairy-like town, built upon a shelving rock perhaps, where the people enjoy a climate of eternal spring. He may ascend to six thousand feet above the sea level in a day's journey, and find himself suddenly transported to a clime resembling some part of New England on a cold, raw November day. Thence he may travel across country over hills and dales, and suddenly find himself upon the edge of a mountain looking down upon a broad valley four thousand feet below him, in the center of which nestles a picturesque little city, which knows no change of seasons at all, but is bathed in the sunshine of an eternal summer.

At least one-third of the population of this country is pure Indian, with no voice in its politics or government whatever. And strange as it may seem, the bulk of this population is concentrated for the most part in the most inaccessible, inhospitable, rugged parts, where it would seem that livelihood for mankind is the most difficult of attainment. For this very reason these people are a rugged, frugal, abstemious lot, their tendency being to attend strictly to their own business and the teachings of their forefathers. From time immemorial they have combined with their chief industry of tilling the soil that of trade, Cortez having obtained from their so-called merchants, who appear to have traveled into Mexico to sell their products, his knowledge of the country before sending Alvarado to subjugate it. These same Indian merchants at the present day set out on long journeys from their native towns loaded with the products of their particular locality. These they carry in immense packs upon their backs held by a strap across their foreheads, and undoubtedly they penetrate regions unknown to them to barter and trade for such things that they are unable to produce at home. In the cold regions of Los Altos, there are tribes who dedicate themselves almost wholly to raising sheep and wheat, and they clothe themselves with garments of wool of their own manufacture. Each pueblo or tribe has a distinct garb of its own in color and fashion, while some of them have a distinct dress for their shepherds. When they have harvested a surplus of wool or wheat, they go forth, perhaps twenty or thirty of them in a band, with their great loads upon their backs, a long staff in one hand and a chief leading the way. They trot along in Indian file, descending the rugged heights, crossing

St. Nicholas Street, Where Several Women Were Killed.



Ruins of the Arena, Where the Bull-Fights Were Held.

St. Sebastian Street, After the Earthquake.

Remains of a House Belonging to a Wealthy Citizen, in Motazan Street.

A GUATEMALAN TOWN RUINED BY EARTHQUAKES.

© 1902 SCIENTIFIC AMERICAN, INC.

rivers and plains, frequently making twenty and thirty miles a day with a load of one hundred and twenty pounds on their backs, and after many days' journey return with equal loads of the produce of other countries and climes.

Sailing down the Pacific coast of Guatemala, the country presents one of the most beautiful sights imaginable. A line of volcanic peaks runs almost parallel with the coast from the frontier of Mexico to that of Salvador. The tablelands rise above the verdure-covered shore, and above these the mountain peaks, many of them capped with snow, and so perfect in form as to give the appearance of having been molded by some gigantic hand. There are some thirty of these peaks classified as volcanoes, and the terrible geological revolutions which have originated from them in times past can only be guessed by the present appearance of the country about them. In some places we find the conglomerations of enormous rocks as though thrown down by violent eruptions, in other places depressions of land where the mountains form colossal walls shutting in the drainage and forming great lakes, and in many places great cracks in the earth where it has been rent asunder and never healed.

But the people toil on, building their cities upon the shelving cliffs, planting their wheat and potatoes upon the very slopes of the most threatening volcano, and when the earth rumbles and shakes, the Indian merely looks up from his hoe, shrugs his shoulder, and if nothing more serious happens, he goes on with his work. An earthquake is nothing to him. If it swallows him up, perhaps then, so much the better. He does not seem to have any particular attachment for life. He is a sad, serious personage, who seldom laughs and never sings. He is entirely resigned to his fate, and seems to care little what that fate is to be.

But with that class of people known as the Ladino, the descendants of the old Spanish settlers, it is entirely different. At the very first mutterings of the earth, which seem to precede the usual earthquake, they are seeking places of safety in the open, and they usually begin to pray with all the vehemence there is in their souls. What is more, they fairly anticipate the earthquake, and are fleeing for their lives before the average foreigner, who is unaccustomed to the seismic disturbances, feels the slightest tremor, and often he stands in the greatest place of danger, wondering what the excitement is all about. My first earthquake occurring during the night, I slept soundly through it all, while other people were tumbling from their beds, falling over tables in the darkness and bruising their shins, in their efforts to get outdoors. The next morning they told me all about the frightful earthquake.

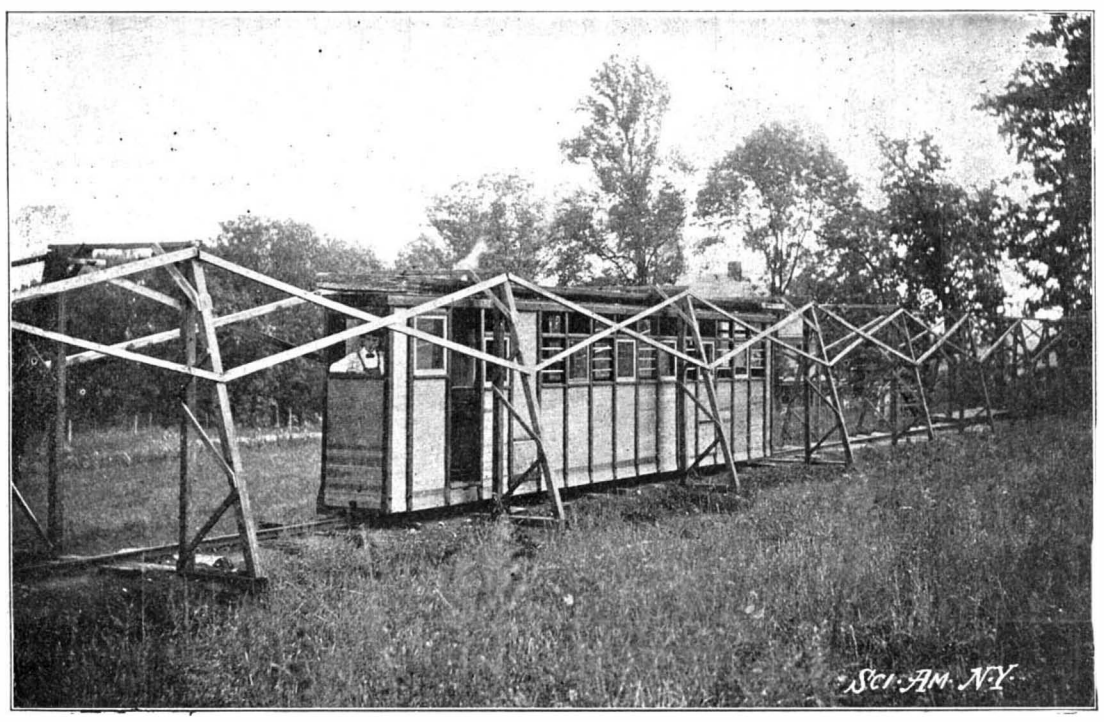
AN EXPERIMENTAL MONO-RAIL LINE.

BY DAY ALLEN WILLEY.

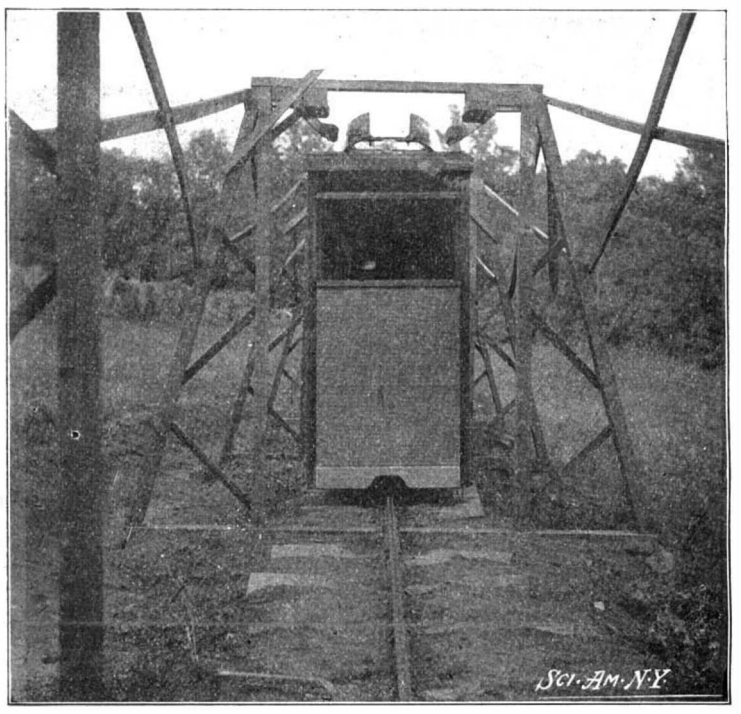
A railway in which the mono-rail system is utilized has been in operation for experimental purposes in the western suburbs of Baltimore for the last few months. It was constructed according to the design of Mr. Howard H. Tunis, who has secured patents on several features of the system which have never before been placed in operation. The track, although but 1,800 feet in length, has the general form of an ellipse, having a grade at several points of two per cent, as well as a number of 28-degree curves. The rail, which is laid in the center of the roadbed spiked to ordinary ties, weighs 30 pounds to the yard, and forms practically the only support to the two cars which are operated over the line, as the framework through which they pass is merely intended to maintain their equilibrium. The framework shown in the illustrations as a series of wooden arches is merely temporary, and will be replaced by steel in the permanent structure. Each archway supports a part of what might be called guiding pieces, which prevent the car from falling to one side.

The cars are large enough to hold 24 passengers. They contain their own motors, which utilize kerosene oil as fuel, steam being generated in an upright boiler and conveyed to a cylinder which moves a pair of sprocket wheels. The larger sprocket wheel, which is made especially heavy for the purpose, is joined to the axle of the forward truck wheel upon which the car moves, so that power is communicated to this wheel directly by means of a chain connection, and it may be termed the driving wheel. The car is supported upon this and the rear wheel only, the rims being grooved to the same depth as the wheels used on ordinary steam standard-gage railway cars. The arrangement of the engine is similar to that of some types employed in automobiles. Although it generates but four horse power, the empty car has been moved around the railroad in 2¼ minutes, or at the rate of 9 miles an hour, while with every seat occupied a rate of 8 miles an hour has been maintained without difficulty. In fact, the engine is so small that it seems almost like a toy. About ½ horse power is utilized in running the water and air pumps, so that actually only 3½ horse power is applied to the movement of the load. The car itself with the engine weighs 3 tons, and when filled with adult passengers weighs between 4 and 5 tons.

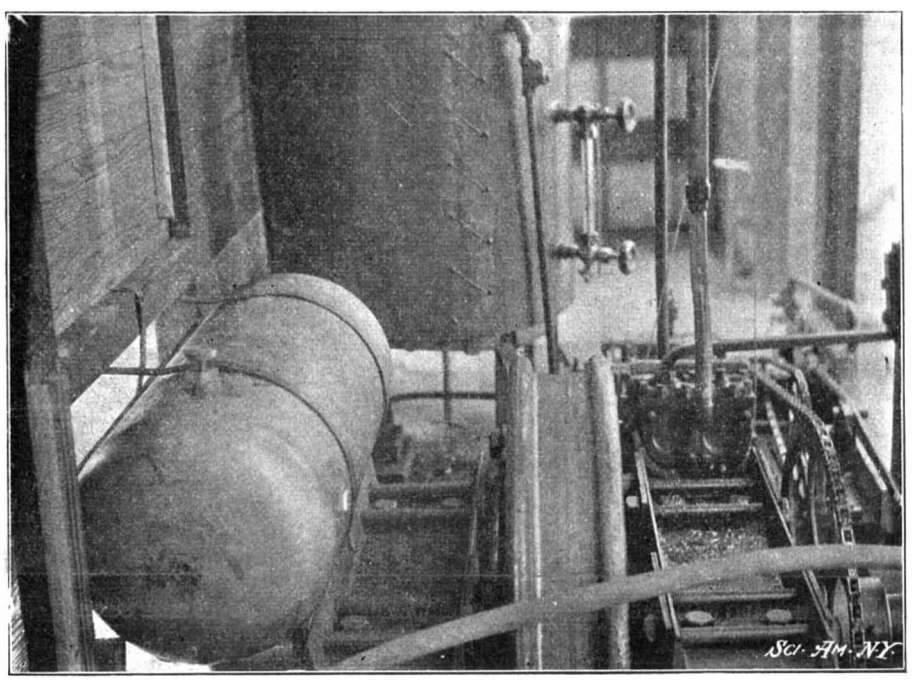
The device which keeps the car from toppling over when in motion is one of the features upon which the inventor has secured a patent. It consists of two strips of wood extending lengthwise along the roof of the car and a series of spring blocks on the archway framework. The strips are slightly curved at the ends, meeting in the form of a V, and as the car moves, they pass between the spring blocks fixed to the archway. The guiding strips and the spring blocks are greased to reduce friction, and the arrangement is such that at least two pairs of spring blocks are continually pressing against the guiding strips. This device prevents swaying even on the most abrupt curves and when running at maximum speed. Ball bearings are utilized to overcome friction in moving the driving wheel, and this is one of the important advantages claimed for the system. Another claim is that the amount of friction is greatly reduced by the use of the single rail, even though the guiding strips on the top are continually in contact with the overhead structure. The fact that a load aggregating nearly five tons can be hauled at the rate of speed mentioned by an engine of such power is also advanced as a claim for its efficiency. The rates of speed given are maintained even upon the highest grades and sharpest curves. A company has been formed to build a railroad 16 miles long in Virginia embodying Mr. Tunis' ideas.



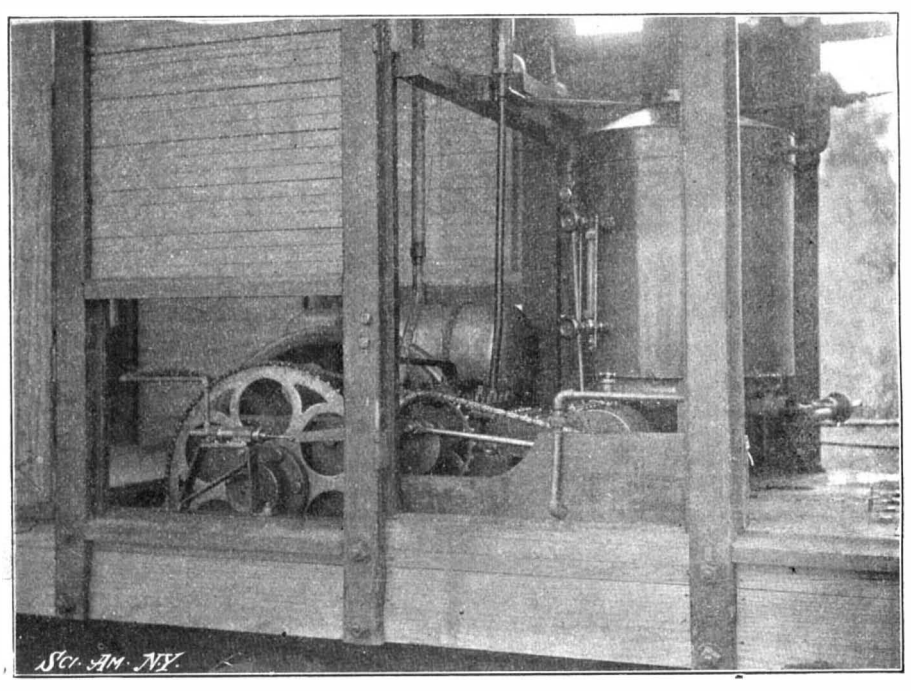
A NEW MONO-RAIL LINE—CAR VIEWED FROM THE FRONT.



REAR VIEW, SHOWING GUIDING STRIP AND SPRING BLOCKS.



VIEW OF ENGINE AND BOILER FROM THE REAR.



SIDE VIEW OF ENGINE, SHOWING CONNECTION WITH TRUCK WHEEL.

© 1902 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Engineering Improvements.

ROTARY PUMP.—O. C. JONES, Philadelphia, Pa. This rotary pump is constructed to be easily reversed and is adapted particularly to be used in connection with an improved rotary engine invented by Mr. Jones, which was recently described in the SCIENTIFIC AMERICAN. The pump comprises a pump cylinder with inlet and outlet orifices, a rotary piston, a swinging abutment mounted in the cylinder, and a wall arranged at one side of the piston turning therewith. The wall is spaced from the adjacent head of the cylinder and is provided with orifices at the respective sides of the piston. A chamber is attached to the wall which communicates with one of the openings in the wall and also with the discharge or outlet orifice.

Hardware.

SOLDERING-IRON.—A. G. KAUFMAN, San Francisco, Cal. Mr. Kaufman's soldering-iron belongs to that class adapted to be heated by burning gas. The invention provides a tool arranged to allow convenient handling and manipulating by tinners, plumbers, and other mechanics, which will insure a uniform internal and external heating of the point without danger of impairment by external influences such as draft, dropping of solder and the like.

NUT-LOCK.—W. D. EVANS and J. C. WIGGINS, Eupora, Miss. A simple and positive nut lock which will not detract from the strength or appearance of the bolt and nut but will rather add thereto, has been invented by Messrs. Evans and Wiggins. The construction of the nut lock is such that it may be used with equally good results upon metal or upon wood. It may be expeditiously and conveniently applied and when once adjusted cannot be shaken loose.

Mechanical Devices.

MACHINE FOR BENDING PIPE-ELBOWS.—E. H. SMITH, Mt. Vernon, Ohio. In the operation of this machine the pipe will be fitted on a mandrel and held by clasps slipped on over the pipe. Jaws are then operated to compress the clasps and pipe and the proper treadle is operated to set a worm into gear with its worm wheel, which thereupon causes a bail to swing upward and tilt the mandrel, bending the pipe elbow, as desired. In thus bending the pipe elbow the preliminary crimps will be forced up between the sections of the clasp and will be pressed into the form of flat ribs or flanges projecting from the surface of the elbow.

DEVICE FOR OPERATING CONCENTRATING-TABLES.—A. W. JOHNSON, Aspen, Colo. Mr. Johnson's invention is in the nature of a mechanical appliance for imparting to the reciprocating tables of ore concentrators and like machines, their necessary shaking movement. The novel construction and arrangement of the various parts afford five or more modified movements of the shaking table. But little power is required for operating the device.

CARTRIDGE-SHELL LOADER.—E. L. WETZIG and G. W. REUST, Junction City, Kans. In this cartridge shell loader, powder and shot holders are employed also a charge receiver arranged to slide beneath them. A lever is provided which is so pivoted that it may swing in both vertical and horizontal planes and engage with this charge receiver. A wad plunger is mounted to reciprocate vertically and is suitably connected with the lever whereby it is forced down with the same in loading the cartridge shell.

COLLAR-BUTTON-VENDING APPARATUS.—M. F. PRICE, Iowa City, Iowa. Mr. Price's invention relates to a machine designed especially for vending collar buttons, and the machine is of such character that it is readily adaptable to coin-controlled operating devices, thus enabling the inventor to provide a coin-controlled collar-button-vending apparatus.

APPARATUS FOR AUTOMATICALLY LIGHTING OR EXTINGUISHING GAS LAMPS.—T. F. WESTENHOLZ, Hellerup, near Copenhagen, Denmark. The lighting and extinguishing of street gas lamps is ordinarily undertaken by lamplighters and entails a considerable expense. In order to overcome this expense the present invention is provided, whereby the lighting and extinguishing of gas lamps may be accomplished automatically at a predetermined hour. This is accomplished by connecting a clockwork with the gas cock, which opens or shuts the latter through the medium of intermediate gearing.

Railway Contrivances.

AIR-BRAKE SIGNALING AND RELEASING DEVICE.—F. H. DUKESMITH, Charlestown, W. Va. The invention provides a simple construction whereby to signal to the train crew whenever the brake is set from any cause whatever, and further to enable the crew to release the brakes while the train is moving. The invention comprises important details of construction.

GRAIN-CAR DOOR.—G. R. GRIGG, Coffeyville, Kans. This car door, though especially designed as a grain door, may be utilized also for other purposes. Its construction is applicable to any car and will be a fixture. It may be made to closely fit in between the jambs, having hinged extensions or wings at its sides to fit back of and against the jambs, enabling the door to be opened outwardly when the wings are folded back by the pressure of the grain or material against it.

Technology.

APPARATUS FOR FREEING AMMONIA FROM GAS LIQUOR.—H. A. ABENDROTH, Berlin, Germany. The present invention relates to improvements in that class of apparatus for the treatment of gas liquor which consists of a number of superimposed cells, in the uppermost of which the crude gas liquor enters to be brought into contact with steam passing upward from underneath. In this treatment the incoming crude liquor is heated to such a degree that some of the ammonia gas is driven off by causing the liquor to descend through the heated column, while at the base of the latter the liquor is mixed with milk of lime in order to liberate the fixed ammonia contained in the liquor and to cause it, together with the evolved steam, to ascend the column.

ART OF MANUFACTURING WHITE LEAD.—C. H. VICKERMAN, Philadelphia, Pa. Mr. Vickerman's invention relates to the manufacture of white lead by the so-called "Dutch" process and it consists in carbonating lead in the presence of fibers of the domestic sumac plant, the fibers being previously leached and thereby divested of coloring-matters, thus preventing discoloration of the white lead as formed.

Vehicles and Their Accessories.

TOE-CLIP.—F. J. and W. H. MCMONIES, Portland, Ore. The toe-clip which is adapted for use in connection with bicycle pedals, comprises a substantially U-shaped bridge-piece which may be secured to the pedal. A flexible strap piece is provided which may be secured to the bridge piece. Means are supplied for adjusting the strap piece to fit varying sizes of feet.

SEAT ATTACHMENT FOR BABY-CARRIAGES.—M. ELWERT, Lodi, Cal. Mr. Elwert's invention relates to seat attachments of buggies, go-carts and similar vehicles, though more particularly for baby carriages, whereby a nurse or other attendant may sit down no matter where the vehicle may be situated, the seat being of such structure as to be readily folded and concealed beneath the body of the vehicle.

Miscellaneous Inventions.

PIN.—A. A. MANNINGS, 188 Alexandra Road, Kilburn, London, England. The invention relates to an improvement in scarf or other pins and has for its object to insure the permanence of the engagement of the pin in the fabric of the article in which it is inserted. The pin is provided at the head with a pointed spur or barb oppositely directed to the point of the shank which is adapted to engage the fabric.

VIOLIN.—M. KRIWULKA and P. E. HOLMQUIST, Philadelphia, Pa. The object of this invention is to provide means for exerting strain or tension on the body of a violin so that the necessity for frequent tightening of the usual strings will not be apparent, and the instrument will not so readily lose its tension over night. The arrangement at the same time secures a more powerful, clear, and voluminous changeable resonance in tone.

CABLE-JOINT.—W. M. MURPHY, New York, N. Y. Means are provided in this invention for joining the lead casing of submarine or other electric cable. When a cable is spliced it is necessary to join the lead covering hermetically. This has heretofore been done by "whipping" a joint around it; but by means of the present invention Mr. Murphy is enabled to dispense with this process and effectually connect the covering.

BARREL-FILTER.—J. J. PRINDLE, Colorado City, Colo. This barrel filter is especially designed for the extraction of precious metals from ore by the "chlorination process," and the primary object of the invention is the provision of a durable and cheap construction which effectually retains sand or pulverized ore in the cask while the valuable solution is being forced to the bottom of the same so as to pass out through the outlet.

GLOVE AND NECKTIE HOLDER FOR BOXES.—J. L. REINER, New York, N. Y. A simple and economic device is provided by this invention which can be conveniently, quickly and durably applied to the bottom of a box and rigidly secured in an upright position in any order of arrangement desired or best adapted to the character of the articles to be held for display in any predetermined groupings.

SCREEN.—H. LE F. SANDERS, Jersey City, N. J. Certain novelties of construction are involved in this improved window screen which permit its ready adjustment to a window of any size. The screen, though readily adjustable to any window, when in place is perfectly rigid and is adapted to slide on strips on the window frames to raise or lower or otherwise dispose it as desired.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 3471.—For a spring motor for running a sewing machine.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 3472.—For dealers in ready-made, adjustable, small frame buildings.

Small Steam Motors. F. G. Grove, Luray, Va.

Inquiry No. 3473.—For veneer-cutting machines suitable for heavy work.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 3474.—For air-compressing machines and a machine for putting up horse radish in glass.

Dies, tools, models. Am. Hardware Co., Ottawa, Ill.

Inquiry No. 3475.—For manufacturers of dynamometers.

Coin operated machines. Willard, 284 Clarkson Street, Brooklyn.

Inquiry No. 3476.—For makers of steam turbines of 2 to 5 horse power.

Dies, stampings, specialties. L. B. Baker Mfg. Co., Racine, Wis.

Inquiry No. 3477.—For the manufacturer of the Baker power pressure blower.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 3478.—For manufacturers of thin sheet celluloid.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 3479.—For manufacturers of gun barrel tubes.

Want you to read our Ad. on page 385. A Money-making Metalworking and Stamping plant for sale.

Inquiry No. 3480.—For parties to make small steel or malleable iron castings.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 3481.—For a hand machine for fringing or raveling old carpet.

Gear Cutting of every description accurately done The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 3482.—For manufacturers of hard compressed paper pulp articles.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 3483.—For makers of electric welding devices.

FOR SALE.—Patent on cheap contrivance that is indispensable in every store. Certain to sell quickly. A. L. & O. Sovelius, Hancock, Mich

Inquiry No. 3484.—For makers of a first-class oat huller.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 3485.—For makers of wheat steamers or cookers for breakfast foods, or for flaking purposes.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 3486.—For dealers in wood used by pattern makers.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3487.—For manufacturers of automobile parts.

Gasoline Automobile Batteries. William Roche's "Autogas" used properly will carry vehicle twice as far as any other battery of same weight. William Roche, inventor and manufacturer, 42 Vesey Street, New York, N. Y., U. S. A.

Inquiry No. 3488.—For makers of fire alarm whistles.

To Ambitious Persons.

A prominent business man of New York City writes that he would like to come in touch immediately with a few well-recommended people who desire a higher education. This gentleman (whose name is withheld at his request) has at his disposal a limited number of Free Tuition Contracts in a well-known educational institution for home study. This school can teach you to become a Practical Engineer, Electrical Engineer, Electric Railway Engineer or Telegraph Engineer, Illustrator, Caricaturist Ad-writer, Journalist, Proof-reader, Bookkeeper, Stenographer. If you are awarded one of these Free Tuition Contracts, the only expense to you while you are studying will be the cost of instruction papers, postage, etc., this you can pay during the first four months. If you are ambitious to improve your station in life, we should strongly recommend that you write to this gentleman at once. Address W. L. B., P. O. Box 53 Madison Square, New York City. Be sure to mention Scientific American.

Inquiry No. 3489.—For a small air pump to be run by an electric motor.

Inquiry No. 3490.—For the makers of the "Naphey" acetylene gas burner.

Inquiry No. 3491.—For the makers of the Duplex motor.

Inquiry No. 3492.—For manufacturers of vending machines.

Inquiry No. 3493.—For parties to make small steel or malleable iron castings.

Inquiry No. 3494.—For manufacturers of dynamos operated by windmill power.

Inquiry No. 3495.—For manufacturers of sorghum mills, with attachment for cutting the bagasse as it leaves the mill,

Inquiry No. 3496.—For planting machines for setting and watering in one operation.

Inquiry No. 3497.—For a patented box or crate which can be taken apart and returned to consigner

Inquiry No. 3498.—For a machine for preparing cotton for felt mattresses.

Inquiry No. 3499.—For makers of brick-making machinery.

Inquiry No. 3500.—For makers of light gasoline or other motors.

Inquiry No. 3501.—For parties dealing in rhodium.

Inquiry No. 3502.—For an outfit for making half-tones.

Inquiry No. 3503.—For machinery for compressing refuse, sawdust or other light material into special blocks or forms, for use as fuel.

Inquiry No. 3504.—For manufacturers of revolving brushes similar to those in carpet sweepers.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled

(8755) L. Q. says: I wish to know the ingredients and proportions—in short, the recipe—for a solder for tin by using which it is not necessary to use acid or other preparation in order to stop small leaks in family tinware. A. The free-flowing solder used by the fakirs is composed of 1 part lead, 2 parts tin, 1 part bismuth. The solder wire is made by flowing the melted solder through small holes in the corner of a square sheet-iron ladle, at the same time drawing the ladle over a cold flat iron surface. A little practice will give you the necessary conditions for making the solder wire uniform in size.

(8756) W. M. S. wants a formula for figuring the horse power, bore and stroke, also speed of four-cycle gasoline engines, and uses 8 horse power, double-cylinder, 350 feet per minute marine type as example. A. The horse power of a four-cycle gasoline engine is the mean explosive pressure multiplied by the cylinder area and one-half the number of revolutions per minute and the stroke in feet. The product divided by 33,000 equals the horse power. The details of engine dimensions, atomizers and vaporizers are now in press in a book on "Gas, Gasoline and Oil Engines," by Hiscox, $2.50 by mail, enlarged edition.

(8757) F. W. L. asks: 1. What is the approximate resistance of a quantity of barley lying loosely in a box of insulating material one foot long by one square inch in cross section, where current is run from end to end? A. The electrical resistance of dry barley under any circumstances would be infinite. It would be an insulator as dry wood is. If the grains are moist, they would conduct to an extent depending on the degree of moisture. 2. How long will it take one ampere of current to decompose one quart of water? A. A coulomb of electricity will deposit 0.00010384 gramme of hydrogen. This is done each second the electricity flows. One quart of water weighs 946.4 grammes. Of this 1-9 is hydrogen, or 105.15 grammes. Divide 105.15 grammes by the number given for hydrogen, and you will have the number of seconds required for one ampere to decompose 1 quart of water.

(8758) J. S. W. asks: 1. How is starch extracted from Irish potatoes, also from the cassava plant? A. Potato starch is usually prepared by rasping the tuber into as fine a pulp as possible, and washing this in water. The milky liquid passes through sieves of increasing fineness until the fiber, etc., are removed. In a settling tank the sand or other heavy matter is separated from the starch and the latter is siphoned off from the top through holes in the sides of the tank. Centrifugal machines are sometimes used for separating the starch from the water. The crude starch is purified by washings and levigation, with passings through sieves and bolting cloth. The purified starch is at last dried in drying rooms. The general process of preparing cassava starch is the same, only the work is done more crudely and by hand. There is a much less proportion of starch than in the potato, and the fiber is more difficult to rasp fine. The sifting is more difficult. The starch is dried in the air under sheds. If the damp starch is heated in shallow pans with constant stirring, the grains burst and adhere together, forming irregular kernels, sold as tapioca. 2. Is there any way of converting a continuous current of electricity into an alternating one? A. Continuous currents are converted into alternating currents, or the reverse, by a rotary converter. The armature has two windings, one of which is motor and the other dynamo. The current in the first drives the armature, and the second winding delivers the current of the sort desired

(8759) G. K. B. says: We have many gas wells here. When the gas comes out it is very cold. Many offer explanations, but I am not satisfied, as I do not believe they are based on scientific principles. Wells are bored about 1,000 feet to gas. A. The gas comes cold from the wells which you describe because it expands from great pressure at a depth of 1,000 feet to atmospheric pressure at the surface of the earth. This is fully explained in Sloane's book on "Liquid Air."

© 1902 SCIENTIFIC AMERICAN, INC.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

November 25, 1902,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acids of niter cake, recovering free and combined, L. Cheeseman, Sr..... 714,145
Acids of the fatty acid series, making, H. von Hochstetter 714,484
Adding machine, F. E. Coffeen..... 714,151
Adjustable seat, Haverly & Solomon..... 714,370
Air brake triple cylinders, truing device for, E. M. Barnes..... 714,631
Air or vacuum motor, M. Arndt..... 714,273
Air tight can and means for dispensing liquid therefrom, C. Marks..... 714,212
Alarm, see Burglar alarm.
Amusement apparatus, F. H. Lippincott.. 714,383
Anchor, land, T. E. Hallett..... 714,176
Animal catcher, C. H. Generaux..... 714,170
Animal trap, H. J. Gaedtke..... 714,470
Automobiles, etc, steering device for, W. L. Mead 714,501
Awning, Johnson & Rond..... 714,187
Bag holder, B. O. Branch..... 714,137
Bag machine, J. V. Matteson..... 714,386
Ballast unloader, G. W. King..... 714,193
Band cutter and feeder, J. Beisch..... 714,632
Basin cover and sewer inlet, catch, Jackson & Pierce 714,185
Battery depolarizer, Lookwood & Banks.. 714,590
Bearing, ball, J. E. Y. Rochester..... 714,612
Bearing, centrifugal machine, H. F. Cline.. 714,561
Bearing for wheels, oilless, H. C. Tazewell. 714,533
Bearings, etc, collar for shaft, A. Riebe.... 714,611
Bed couch, J. Hoey..... 714,375
Bed, folding, L. E. Olney..... 714,229
Bed, folding, J. A. Lesperance..... 714,495
Beet digging machine, E. & A. Pruvot.... 714,518
Bicycle frame, H. W. Freed..... 714,571
Bicycle saddle cloth, F. J. Schurmann..... 714,245
Binder knotting device, automatic, F. A. Ryther 714,242
Binocular glass, Warner & Fecker..... 714,340
Body brace, J. U. Adams..... 714,124
Boiler flue rattler, H. O. Westmark..... 714,344
Bottle closure, L. D. Parks..... 714,326
Bottle filler, siphon, J. K. Turajski..... 714,264
Bottle filling and stoppering machine, R. G. Nash 714,511
Bottle, non-refillable, E. M. de Valdes.. 714,338
Bottle, nursing, A. Blatin..... 714,133
Bottle, nursing, L. Anderson..... 714,552
Box, M. A. Osburn..... 714,515
Braiding carrier tension, J. A. Turner.... 12,058
Bromin from brine, extracting, H. H. Dow. 714,160
Brush, scrubbing, J. B. Martin..... 714,215
Buckle, N. I. Hecht..... 714,579
Buckle, harness, B. F. George..... 714,171
Buckle or frame, H. J. Gaisman..... 714,471
Burglar alarm or door signal, W. R. Edelen, reissue 12,057
Bustle, H. H. Taylor..... 714,532
Button setting machine, E. B. Stimpson... 714,336
Cabinet, kitchen, G. W. Harris..... 714,480
Can, see Air tight can.
Can closure, milk, J. C. Howell..... 714,376
Can for bakery or similar products, M. J. Nash 714,393
Cane trash gatherer, cutter, and spreader, sugar, H. B. Gray..... 714,475
Canopy, J. M. & E. E. Truscott..... 714,650
Cap closure, sheet metal, E. Hoffman..... 714,303
Car brake, E. Posson..... 714,236
Car fender, W. B. Collins..... 714,453
Car, non-telescoping, G. E. Dickson..... 714,640
Car safety attachment, B. Long..... 714,312
Car starter, Trott & Sutphin..... 714,623
Car, tank, Rogers & Shotwell..... 714,397
Car window roller screen, F. A. Carpenter 714,362
Carbureter, C. I. Tenney..... 714,414
Carbureter, explosive motor, E. L. P. Mors. 714,597
Card serving machine, automatic, G. A. Armstrong 714,553
Cash and parcel carrier, N. Leblanc.... 714,202
Casket lid, Rappleyea & Sparks..... 714,609
Caster, M. G. Daniels..... 714,636
Cells, vaults, etc., lining for, D. F. Youngblood 714,349
Celluloid, mounting stones, etc., in, M. H. Brown 714,447
Cement, casting, W. Perry..... 714,647
Chair seat surfacing machine, C. A. Stark.. 714,529
Champagne freezer, J. Trafford..... 714,415
Change feed mechanism, J. Edgar..... 714,567
Chenille cloth cutting machine, P. McDonald 714,646
Chute and automatically opening or closing door for air tight chambers, S. P. Stevenson 714,619
Cigar or cigarette holder, paper rolled, H. Heisler 714,580
Cigars, machine for preparing leaf tobacco for manufacture into, P. H. Ertheiler 714,289
Cigarette paper, applying cork strips to, G. Nast 714,601
Clamp for ropes, straps, chains, etc, L. M. Chapman 714,144
Clipper, R. F. Werk..... 714,543
Clutch or coupling, friction, H. D. Loria.. 714,209
Coin depositing apparatus, G. F. Lehrke.. 714,587
Coke ovens, etc, wall construction for, H. Koppers 714,195
Collar foundation, A. A. Dieter..... 714,461
Column for architectural purposes, sectional, F. A. Spencer..... 714,251
Commutator oil guard, W. F. Dawson..... 714,158
Compasses, extension, B. E. Gove..... 714,575
Composition of matter, J. Poliakoff..... 714,235
Condenser for steam propelled cars or vehicles, air, Bridson & Brough..... 714,445
Converter, G. C. Carson..... 714,449
Converter, continuous, G. C. Carson..... 714,451
Converters, starting rotary, W. B. Potter. 714,395
Conveyance, passenger and freight, J. H. Marsh 714,592
Conveyor, M. Bradfield..... 714,279
Conveyor, B. H. Alvey..... 714,432
Conveyor apparatus, M. Bradfield..... 714,278
Conveyor system, H. W. Blaisdell..... 714,357
Conveyors, reversing can for endless, P. B. Clarke 714,149
Cooler, M. A. Simmons..... 714,248
Copying bath, J. M. Nicholas..... 714,512
Corset and gown stay, D. P. McKenney.... 714,322
Cot, folding, I. Stanley..... 714,335
Cotton chopper and cultivator, combined, L. A. Miller..... 714,505
Couch rolls, guard board and cleaner for, Willmott & Lovett..... 714,548
Coupling, E. Vogel..... 714,266
Cream separator, Klay & Scheid..... 714,194
Crematory, F. L. Decarie, reissue..... 12,059
Culinary appliance, Worley & Sullenbarger. 714,430
Culinary vessel, Johnson & Borell..... 714,448
Cultivation apparatus, steam, Fowler & Benstead 714,570
Cultivator, J. E. Gamalielson..... 714,168
Cultivator, J. O. Lawrence..... 714,493
Cultivator, three row disk, W. W. Bott.. 714,442
Cultivator tooth, adjustable, F. G. Hoag.. 714,642
Current motors, controlling alternating, C. P. Steinmetz.....714,411 714,617
Currents in alternating systems, increasing the number of phases of, A. G. Davis.. 714,638
Currents, producing multiphase currents from single phase, A. G. Davis..... 714,639
Curtain poles, etc., means for connecting ornamental heads or knobs to, F. K. Phillips 714,231
Dental engine handpiece, A. W. Schramm, et al..... 714,613
Dental furnace, electrical, Hewett & Smith 714,373
Derrick for loading or unloading vessels, N. E. Porter..... 714,328
Derrick for vessels, coal, Eliasen & Nelson 714,465
Detector bar clip, J. P. Coleman..... 714,365
Detonator, J. W. Fowler..... 714,469
Diseases by vacuum and air pressure, apparatus for treating, R. Watson..... 714,342
Disk cutter, J. Brooks..... 714,359
Display box, H. Wertz..... 714,544
Display tray and case, E. F. Winters.... 714,427
Distilling apparatus, liquor, J. C. Bertsch.. 714,438
Door check, C. F. Sullivan..... 714,255
Draft regulating mechanism, automatic, I. P. Taggart..... 714,259
Drill, see Rachet drill.
Drying humid material, apparatus for, A. Huillard 714,487
Dye and making same, orange brown sulfur, Weinberg & Lange..... 714,542
Electric currents, increasing the number of phases of, A. G. Davis..... 714,637
Electric cut out, H. N. Potter..... 714,607
Electric distribution system, H. W. Buck.. 714,360
Electric machine regulating device, dynamo, C. W. Kragh 714,382
Electric switch, N. Marshall..... 714,593
Electric switches or current breakers, tripping, J. D. Hilliard, Jr..... 714,181
Electrical distribution, phase modifier and system of, A. G. Davis..... 714,156
Electrical distribution system, A. G. Davis, 714,154, 714,155
Electrical receptacle, P. H. Fielding.714,290 714,291
Electrode for arc lamps, composite, A. Blondel 714,277
Electrolytic cell, M. C. Rypinski..... 714,400
Electromagnet, polarized, L. Cerebotani.. 714,452
Elevator operating mechanism, Churchill & Christiansen 714,147
Elevator or storage bin construction, Cleveland & Stahr..... 714,363
Elevator well door, W. A. Cross..... 714,153
Embroidering machine, A & J. B. Bastie.. 714,129
Engine reversing gear, steam, L. D. Epperson 714,368
Envelop, W. S. Harrison..... 714,179
Evaporating apparatus, vacuum, C. Ordway 714,513
Exerciser, M. Duffner..... 714,463
Exercising apparatus for straightening the legs, F. Langel..... 714,309
Explosive engine, F. Lagoutte..... 714,492
Eyelet, E. Kempshall..... 714,191
Fastening inserting machine, E. T. Freeman 714,572
Faucet for dispensing beverages and filling siphon bottles, J. F. Doyle..... 714,161
Feed regulator, boiler, O. E. & E. E. Clark 714,148
Feeder, boiler, E. J. Wood..... 714,549
Feeder, stock, J. P. Bowmaker..... 714,557
Fence post brace, E. Love..... 714,644
Fence post, metal, T. Beerbower..... 714,275
Fence posts, machine for molding concrete, C. H. Hutchings..... 714,184
Fence, wire, J. Harris..... 714,178
Fence wire tightener, C. W. Hoagland.. 714,302
Fertilizer distributer, E. C. Smith..... 714,527
Fiber machines, cutter head for wood, I. W. Hoover..... 714,182
Filter press, F. S. Guy..... 714,174
Fireplace, M. J. Robbins..... 714,241
Fireplace fixture, W. A. Posey..... 714,517
Fireproof window, L. D. Biersach..... 714,131
Folding box, E. L. Brown..... 714,138
Folding chair, Crandall & Wood..... 714,562
Frame joint, Sager & Green..... 714,402
Furnace bottom and making and repairing same, J. Dunford..... 714,565
Furniture adjusting device, F. L. Harris.... 714,177
Garment fastening, M. M. McGrath..... 714,390
Garment support, B. H. Scott..... 714,406
Gas burner, safety, L. F. Ducker..... 714,162
Gas burner safety by pass device, J. Vaillant 714,265
Gas check, adjustable, M. D. Compton..... 714,454
Gas generator, acetylene, E. R. Angell.... 714,125
Gas generator, acetylene, N. A. Renstrom.. 714,238
Gas generator, acetylene, F. M. Moore 714,318, 714,319
Gas generator, acetylene, H. Kinsey, et al 714,490
Gas regulator, G. A. Brachhausen..... 714,136
Gate, see Water gate.
Gear, changeable speed, A. C. Lindgren.. 714,496
Gear for motor cars, tools, etc., variable speed and reversing, J. E. Mennessier 714,504
Glass cutter's board, A. T. Whitehouse.... 714,545
Glass melting and mold charging apparatus, Bridgewater & Haley..... 714,558
Glassware, machine for making hollow, G. C. Pyle 714,396
Glazier's point, T. N. Parker..... 714,516
Grading and scraping machine, road, W. S. Paget 714,325
Grain elevator, Levy & Anderson..... 714,203
Grass or grain cutter, T. F. McDonald.... 714,222
Grip wrench, automatic, J. R. Cogan..... 714,364
Hair pin, T. C. Allen..... 714,431
Hammer, pneumatic, J. T. McGrath..... 714,321
Hammock frame or support, W. Augustus. 714,554
Hammock support, D. F. Youngblood..... 714,348
Handling material in bulk, apparatus for, P. B. Clarke 714,150
Harness connection for neck yokes, J. F. Bline 714,134
Harrow, rotary, H. F. Jurs..... 714,378
Harvester cord carrier, self-binding, J. A. Sharp 714,407
Hat fastener, G. E. Lacy..... 714,198
Hay carrier, elevated, S. Jacobs..... 714,306
Heating apparatus, Kennedy & Cushing.... 714,192
High potential switch, C. C. Badeau..... 714,436
Hinge, friction, V. C. Luppert..... 714,384
Hod, J. Dorey..... 714,287
Hoisting and conveying apparatus, W. McIntosh 714,224
Horseshoe, A. F. Kerns..... 714,380
Hose coupling, J. F. Sargent, Jr..... 714,243
Hose coupling, H. Grubbs 714,476
Hose, metallic spiral, E. Witzemann..... 714,429
Hose protector, railway track, H. H. Arnold 714,126
Hose rack, C. Wright..... 714,628
Hose supporter hook, M. B. Hammond..... 714,300
Hot air and gas engine, combination, C. A. Anderson et al..... 714,353
Hot air and gas engine, combined, C. A. Anderson et al..... 714,352
Hot water heater, O. Lobel..... 714,588
Ice cream disher, W. J. Bolland..... 714,440
Ice making machine, R. F. Learned..... 714,494
Iced goods, drier for bakery or similar, F. L. Wetzel 714,420
Icing frame truck, F. L. Wetzel..... 714,417
Icing or coating of baking products, machine for facilitating the, F. L. Wetzel 714,419
Icing or coating of cakes, biscuits, etc., apparatus for facilitating the, F. L. Wetzel 714,418
Incubator, I. Morrow..... 714,596
Induction motor, C. P. Steinmetz..... 714,412
Injector, R. D. & J. C. Metcalfe..... 714,217
Internal combustion engine, C. Hendricks.. 714,180
Iron and steel, apparatus for the manufacture of, G. J. Snelus..... 714,616
Iron shears, cold, J. C. Burgess..... 714,361
Jails, interlocking bar grating for, D. F. Youngblood 714,350
Joint or pivotal connection for double armed tools or appliances, H. Malignon 714,211
Knitting machine stop motion, F. S. Forry. 714,468
Knob attachment, S. Fader..... 714,466
Knuckle pins, stop block for broken or headless, G. Taggart 714,258
Label, G. E. Howard..... 714,485
Lacing hook, A. K. Lovell..... 714,591
Lacing hook, E. Kempshall..... 714,643
Lamp chimney attachment, A. T. Osbron.. 714,514
Lamp coil, arc, W. H. Northall..... 714,226
Lamp, gas, T. Brabson..... 714,444
Lamp, incandescent gas, T. Brabson..... 714,443
Lamp, incandescent hydrocarbon, G. Galkin 714,472
Lamp liquid level indicator, W. R. Jeavons 714,377
Lamp, signal, C. H. Dressel..... 714,564
Lamp socket, P. H. Fielding..... 714,292
Lightning arrester, J. E. Cordovez..... 714,455
Liquid cooling boxes, means for supporting pipe coils for, A. F. Meyer..... 714,218
Lister, sulky, G. Engelmann..... 714,288
Locks. See Sash lock.
Lock, Dalton & Cross 714,458
Loom positive shuttle motion, F. S. Gable 714,294
Loom shuttle, E. E. Shelters..... 714,408
Loom shuttle motion, J. A. Gendron..... 714,169
Loom weft replenishing mechanism, Baker & Kip 714,274
Lubricating axle bearings, means for, J. Abbott 714,123

(Continued on page 383)

WOOD or METAL Workers

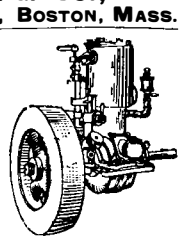
Without Steam Power should use our Foot and Hand Power Machinery. Send for Catalogues A—Wood-working Machinery, B—Lathes, etc.
SENECA FALLS MFG. CO.
695 Water St., Seneca Falls, N.Y.

ENGINE & FOOT LATHES MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

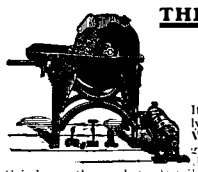
Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses.
SHEPARD LATHE CO., 133 W. 2d St., Cincinnati, O.

TOOLS Every kind of Tool for Steam, Gas, and Water Fitters. Every Tool has our personal guarantee. We have been the Leading Tool Manufacturers for Fifty Years . . .
WALWORTH MFG. CO.,
128 TO 136 FEDERAL ST., BOSTON, MASS.

GASOLINE ENGINES
Marine & Stationary
from 1-4 to 16 H. P.
A thoroughly satisfactory engine at a moderate price.
Write for catalogue.
THE CLIFTON MOTOR WORKS,
233 E. Clifton Ave., Cincinnati, O

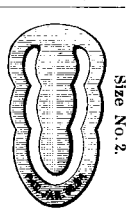


BICYCLE TIRE REPAIRING.—THE Mending of Single Tube Tires.—A practical article illustrating the method of inserting patches and plugs with pliers and pluggers, together with rubber band plugging and the use of puncture bands. 9 illustrations. Contained in SUPPLEMENT 1102. Price 10 cents. For sale y bMunn & Co. and all newsdealers.



THE B. F. BARNES WATER EMERY TOOL GRINDER
Swings a 24x2-inch Wheel.
It has no pump but a simple trough uniquely arranged for supplying water to the Wheel. Easily manipulated and cannot get out of order. Without question it is the most practical and durable wet tool Grinder on the market. Details on request.
B. F. BARNES COMPANY, Rockford, Ill.

THE EUREKA CLIP
The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by Consolidated Safety Pin Co., Box 121, Bloomfield, N. J.



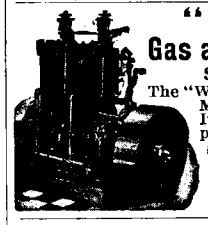
Queen Transits and Levels
High Grade Instruments with the Latest Improvements.
160 page Engineering Catalogue on application. THE QUEEN 240 page Mathematical Catalogue on application.
ENGINEERS' AND DRAFTSMEN'S SUPPLIES.
QUEEN & CO., Optical and Scientific Instrument Works,
59 Fifth Ave., New York. 1010 Chestnut St., Phila.

D. L. HOLDEN
REAL ESTATE TRUST B'LDG, PHILA., PA.
SOLE MANUFACTURER
REGEALED ICE MACHINES
SEE FIRST PAGE SCIENTIFIC AMERICAN SEPT. 2. 1899

BOGART GAS ENGINES

Double Cylinder, 50 h. p and upward to 500.
FARRAR & TREFTS,
Steam Engine & Boiler Works....
54 to 56 Perry Street, BUFFALO, N. Y.
Catalogue on Application

Second Hand Gas and Gasoline Engines
at a saving of 50 per cent., always in stock from 1 to 30 h. p., all makes. Stationary only. In thorough order and guaranteed. Your needs in Gas or Gasoline Engines we keep.
CALLESON MOTOR CO., 271 West St., New York.



"WOLVERINE" Gas and Gasoline Engines
STATIONARY and MARINE.
The "Wolverine" is the only reversible MarineGas Engine on the market. It is the lightest engine for its power. Requires no licensed engineer. *Absolutely safe.* Mfd. by
WOLVERINE MOTOR WORKS,
12 Huron Street,
Grand Rapids, Mich.

GASOLINE AUTOMOBILES.—VALUable illustrated articles on the above subject containing many details of the motors and vehicles, are contained in SUPPLEMENT Nos. 1099, 1270, 1295 and 1311. Price 10 cents each. For sale by Munn & Co. and all newsdealers.

Are You Successful IN ALL YOUR UNDERTAKINGS? Would you exert a magic influence over others, cure diseases without drugs, acquire a marvelous memory, a magnetic personality, a fine physique? Our new

FREE BOOK

is full of startling secrets never before revealed. It enables you to know at a glance the secret natures, talents and weaknesses of others. You can gratify your highest ambitions, make money easily and become a veritable leader of men, if you will follow its teachings. Write for it to-day. Send no money. It's free. Address
Columbia Scientific Academy, Dept 193L.
1931 Broadway, New York City.

Dr. Deimel Underwear

The Dr. Deimel Linen Underwear means warmth, protection, and health to every one—young and old—it is the best that money can buy.

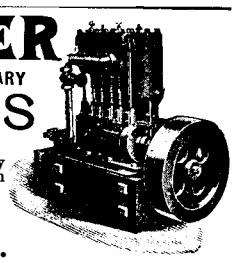
All genuine Dr. Deimel garments bear this trade-mark.

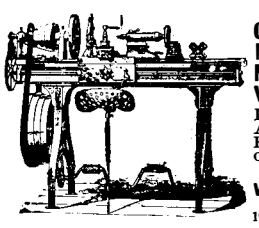
Wear it this winter as a safeguard against the cold-catching habit.

For catalogue and samples of material address
The Deimel Linen-Mesh Co.,
Dept. J. 42—491 Broadway, N. Y.
OR
SAN FRANCISCO, CAL., 111 Montgomery St.
WASHINGTON, D. C., 728 Fifteenth St., N. W.
BROOKLYN, 510 Fulton St.
MONTREAL, CAN., 2202 St. Catherine St.
LONDON, W. C., ENG., 83 Strand, (Hotel Cecil).

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1182. Price 10 cents. For sale by MUNN & CO., 361 Broadway, New York City, or by any bookseller or newsdealer

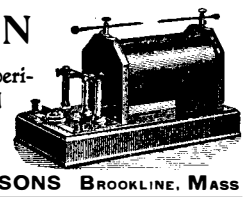
PALMER MOTORS
MARINE and STATIONARY
2 and 4 CYCLE
are no experiment, as they are in successful operation in all parts of the world.
Launches in stock.
Send for Catalogue.
PALMER BROS.,
Cos Cob, Conn.





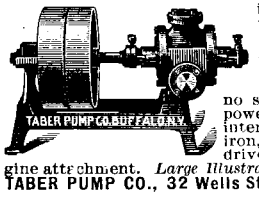
FOR GUNSMITHS, TOOL MAKERS, EXPERIMENTAL & REPAIR WORK, ETC.
From 9-in. to 13-in. swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle.
Send for Catalogue.
W. F. & JNO. BARNES CO.
Established 1872.
1999 Ruby St., ROCKFORD, ILL.

INDUCTION COILS for experiments in X rays and other electrical work.



Catalogue Free.
E. S. RITCHIE & SONS BROOKLINE, MASS

PERFECT - PUMP - POWER.

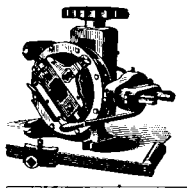


is attained only in the TABER ROTARY PUMPS
They are mechanical simple and durable. Will pump hot or cold fluid, thin or thick. Requires no skilled mechanic. Most power at least cost. All parts interchangeable. Made of iron, steel or bronze. Can be driven by belt, motor or engine attachment. *Large Illustrated Catalogue free.*
TABER PUMP CO., 32 Wells St., Buffalo, N.Y., U. S. A.

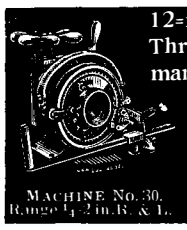
If you want the best CHUCKS, buy Westcott's

Little Giant Double Grip Drill Chucks, Little Giant Drill Chucks Improved, Oneida Drill Chucks, Cutting-off Chucks, Scroll Combination Lathe Chucks, Geared Combination Lathe Chucks, Plain Universal Lathe Chucks, Independent Lathe Chucks. Made by
Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish or German.
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

ARMSTRONG'S No. 0 THREADING MACHINE



Can be attached to bench or post. Designed for threading the smaller sizes of pipe, iron or brass, also bolts. Has two speeds, one for pipe ⅛ to 1 inch; the other for pipe 1¼ to 2 inches, inclusive. Uses the regular Armstrong adjustable dies. Other attractive features. Send for particulars. The Armstrong Mfg. Co., 139 Centre Street, New York. Bridgeport, Conn.



12-inch Pipe cut off and Threaded with ease by one man and a
FORBES PATENT DIE STOCK
Smaller sizes proportionately easy. *Send for Catalogue.*
THE CURTIS & CURTIS CO.,
6 Garden St., Bridgeport, Conn
MACHINE No. 30. Range 1¼-2 in. R. & L.

© 1902 SCIENTIFIC AMERICAN, INC.

CHRISTMAS DIAMONDS On Credit

The $5 or $10 which you would pay for a cheap and trashy gift for the loved one's Christmas, would make the first payment on, and secure the immediate delivery of a beautiful Diamond ring, brooch, locket, earrings, stud, scarf pin, cuff buttons, watch or other article selected from our million dollar stock. A Diamond is a gift that will last forever and every day be a well-spring of delight to the wearer, and a perpetual reminder of the giver and his generosity.

HOW TO DO IT: Send for our handsome, new illustrated Catalogue which shows thousands of beautiful things for Christmas—all goods being reproduced by photograph—select what you like and we will send it to your home, place of business or Express office, where you may examine it critically. If you like it and want to keep it, pay one-fifth of the price and send us the balance in eight equal monthly payments.

REMEMBER: We pay all Express charges, give a written guarantee with every Diamond; make liberal exchanges, allowing the full price paid in exchange for other goods or a larger Diamond, or cheerfully refund all that you have paid, if the goods are not entirely satisfactory.

IT IS SAFE to send us money with order, but you need not pay a penny until you get the goods if you prefer not to do so. We are the largest house in the world in our line of business and one of the oldest—Established in 1858. Our references are any bank in America. For instance: Ask your local bank how we are rated in Dun's or Bradstreet's book of commercial ratings. You will be told that we stand at the top in credit, promptness and responsibility.

All you need to do is to make a selection, and enjoy all of the advantages of our **Liberal Credit System.** There is nothing disagreeable to be anticipated, no publicity, delay, security, interest, or in fact anything that you would not experience in shopping at your home store. Our catalogue explains every feature of our system, terms, goods and prices; is a work of art and worth its weight in gold to any Christmas purchaser. A postal card today will fetch it.

TO CASH BUYERS: If you want to buy a Diamond for cash, we will allow you a discount of eight per cent. Wear it one year or less, then if you wish, bring it back and get spot cash for all you paid—less ten per cent. the reasonable cost of doing business. For instance: suppose you buy a fifty dollar Diamond and wear it one year, you could then send or bring it back and get $45 in cash. It will thus cost you but $5 to wear a splendid Diamond a whole year, or less than ten cents per week. This is only one of the many unique and liberal innovations originated by us in selling diamonds to distant customers. We make every transaction pleasant, satisfactory and absolutely safe, for we will cheerfully refund any money sent us, if goods are not exactly what you desire.

Write today for our catalogue, or tell us what you would like to have us send for your examination. There is no time to lose, for very soon we will be overwhelmed with rush Christmas orders from every corner of the country. Do not wait until the rush begins.

LOFTIS BROS. & CO.,
Diamond Importers and Manufacturing Jewelers,
Dept. 4-B 92, 94, 96 and 98 State Street,
Chicago, Ill., U. S. A.
Opposite Marshall Field & Co.

Overcoat $2.00

Short Box Overcoat adapted for wet and dry weather. Made from the **famous waterproof cloth.** Write for sample.

DELAWARE RUBBER CO.
Dept. 15, 631 Market St.,
PHILADELPHIA, PA

JUST READY.

DIES

THEIR CONSTRUCTION AND USE

For the Modern Working of Sheet Metals.

By JOSEPH V. WOODWORTH

This book is a complete treatise on the subject and the most comprehensive and exhaustive one in existence. A book written by a practical man for practical men, and one that no diemaker, machinist, toolmaker or metal-working mechanic can afford to be without.

Dies, press fixtures and devices from the simplest to the most intricate in modern use, are shown, and their construction and use described in a clear, practical manner, so that all grades of metal-working mechanics will be able to understand thoroughly how to design, construct and use them, for the production of the endless variety of sheet-metal articles now in daily use.

Many of the dies described in this book, were designed and constructed by the author personally, others under his personal supervision, while others were constructed and used in the press rooms of some of the largest sheet-metal goods establishments and machine shops in the United States. A number of the dies, press fixtures and devices, which form a part of this book, have been selected from over 150 published articles, which were contributed by the author to the columns of the "American Machinist," "Machinery" and the "Age of Steel," under his own name.

No obsolete die, press fixture or device has found a place in this book; every engraving between its covers represents the highest that has been attained in the development of each type described. The descriptions of their construction and use will enable the practical man to adapt them for facilitating, duplicating and expediting the production of sheet-metal articles at the minimum of cost and labor.

Every Manager, Superintendent, Designer, Draftsman, Foreman, Diemaker, Machinist, Toolmaker or Apprentice, should have this book.

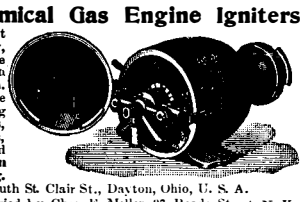
Octavo. Cloth. Very Fully Illustrated.
Price $3.00 Postpaid.

MUNN & CO., Publishers, 361 Broadway, New York

Lubricator cup, E. L. Rampazzi 714,329
Mail box, C. H. Shuttleworth 714,409
Mail distributing case, adjustable, H. F. W. Mohr 714,220
Mandrel or chuck, expansible, J. H. Bryan 714,448
Measuring device, counter, J. C. W. Meyer 714,219
Measuring instrument, electrical, C. W. Atkinson 714,127
Metal, treating, G. C. Carson 714,450
Metal wheels, making, J. F. Steward 714,253
Metals from solutions containing same, apparatus for separating, S. T. Muffly .. 714,598
Metals from solutions containing same, precipitating, S. T. Muffly 714,599
Metallic tube, flexible, C. Rudolph 714,332
Metallurgical product or alloy, J. Stevenson, Jr. 714,618
Milk, aerating and preserving, R. G. Nash .. 714,510
Milk cooler, Daniel & Shackelford 714,459
Mining car cage, W. Towers 714,262
Mirror, toilet, E. M. Gover 714,297
Mixing tank, J. F. Lybrink 714,315
Moistening and closing envelopes, etc., apparatus for, J. R. Turner 714,624
Mold, W. F. J. Lutz 714,385
Mold, A. A. Clark 714,560
Molder's flask, F. Lips 714,207
Molding machine, Day & Anderson 714,285
Mop wringer, W. W. M. Hickey 714,374
Motor regulation, R. T. Lozier 714,210
Motor starting device, induction, A. H. Abell 714,351
Mouse trap, R. Chasse 714,281
Muffle furnace, E. Geille 714,473
Muffler, exhaust, W. Barber 714,128
Music chart, C. T. Meredith 714,316
Navigating or surveying instrument, J. B. Blish 714,276
Neck forming tool, E. Hoffman 714,304
Nitro compounds, reducing aromatic, E. Wirth 714,428
Oil burner, Pfeiffer & Staples 714,394
Oil burner, crude, M. A. Fesler 714,467
Oiler, car journal, E. Armstrong 714,272
Oiling device, automatic, G. W. Thurston .. 714,337
Opera chair, J. A. Wilkinson 714,547
Ore concentrator, dry, H. M. Sutton et al. 714,257
Ore conveying surface for electrical separators, H. M. Sutton et al. 714,649
Ore roasting furnace, T. Edwards 714,464
Ores, magnetically and statically treating, H. M. Sutton et al 714,256
Outlet box, E. W. Muller 714,600
Oven attachment, D. M. Wallace 714,537
Oven, bake, C. Kleinknecht 714,491
Oxalates, making, A. Wiens 714,347
Pail and cooker, combined dinner, J. T. Bluff 714,633
Pail or package lining, J. A. McBride 714,320
Paper clip or fastener, O. Mussinan 714,388
Paper feeding or other machines, automatic stop mechanism for, G. R. Williams 714,423
Paper maker's stuff chest, F. W. McKenney 714,391
Paper pail, W. G. Haas, reissue 12,060
Paper pulp, bleaching, R. C. Menzies 714,216
Paper, toilet, W. M. Davis 714,652
Parer and corer, fruit, G. Laws 714,310
Peat briquets, producing, G. Hartmann .. 714,578
Pen, fountain, A. T. Cross 714,283
Pen, pencil, etc., holder, C. F. Walter .. 714,538
Phonograph horn or megaphone, collapsible, J. E. Storms, Jr. 714,620
Phosphate and making same, J. Reese 714,331
Photographic light screen, E. F. Beckwith. 714,356
Photographic printing frame, C. H. Stevens 714,413
Photographic purposes, copy holder for, H. R. Schoonover 714,334
Piano players to pianos, device for fastening, J. H. Chase 714,635
Pin. See Hair pin.
Pipe coupling, C. Vandall 714,625
Pipe wrench, W. H. Rawe 714,619
Planter lister attachment, I. J. Kaar 714,308
Plumbing and leveling device, P. M. Olsen 714,324
Plunger mechanism, G. T. Cooley 714,152
Pneumatic elevator and weigher, Bradford & Hilleary 714,358
Pole, metallic, M. Ferguson 714,568
Polishing cylinders, paper fastening for, F. E. Schmitt 714,244
Post cap, L. Lane 714,199
Power device, D. Lubin 714,313
Printing press platens, device for delivering paper to, W. G. Johnston 714,489
Propeller shaft reversing gear, A. L. Kull. 714,197
Protective system, A. H. Armstrong 714,355
Pulley covering machine, G. M. Birling 714,556
Pump, A. W. Weaver 714,416
Pump valves, actuating liquid, G. B. Petsche 714,604
Pump valves, apparatus for actuating liquid, G. B. Petsche 714,603
Punching bag support, H. D. Crippen 714,456
Punching bag support, G. S. Maxwell 714,500
Punching machine, J. Sadowsky 714,401
Punching tool, hydraulic, C. Wigtel 714,546
Puzzle, G. O. Willey 714,421
Rail joint, L. F. Schodde 714,405
Rails of tramway or railway lines, method of and means for the fixation of track, W. J. Foot 714,167
Railway safety guard, W. Morsehead 714,507
Railway signal, J. A. Guinn 714,173
Railway signaling apparatus, M. D. Moore 714,595
Railway switch, A. C. Cambridge 714,142
Railway switch, street, Roberts & Mann .. 714,240
Railway tie, J. E. York 714,270
Railway tie, J. Bryne 714,559
Railway track joints, graduated reinforced arched angle bar for, G. H. Williams .. 714,422
Railways, protector for third rails of electric, H. Brooks 714,446
Railway electric motor cooling system, Mailloux & Gotshall 714,497, 714,498
Range, cooking, H. J. Mathias 714,645
Range finder, C. A. Trotter 714,363
Rapid transit line, elevated, I. H. Finchum 714,293
Ratchet drill, H. & M. Bennosche 714,437
Ratchet wrench, F. F. Landis 714,586
Razor guard, Schreiber & Klier 714,524
Razor stropping machine, W. Tapp 714,622
Regenerative system, A. G. Davis 714,157
Regenerative system, M. T. A. Kubierschky 714,196
Rein guide, H. N. Martin 714,214
Rolling, wrapping, or winding machine, J. Cunning 714,457
Rolling mill, H. L. Thompson 714,260
Rolls, mold for making French, B. Yere .. 714,550
Rotary engine, J. W. Larimore 714,200
Rotary engine, J. F. Williams 714,424 714,425
Rotary engine, S. J. Johnson 714,582, 714,583
Ruler attachment, O. Schaller 714,404
Ruling machine, E. Graber 714,576
Ruling edges, parallel motion for, R. Marx 714,594
Sample and ticket holder, dry goods, Smith & Jones 714,249
Sandpaper holder, A. Shurick 714,247
Sash holder, H. Flanders 714,569
Sash lock, automatic, S. G. Wellman 714,343
Saw, railway cut off, B. G. Luther 714,314
Sawmill set works, J. Walton 714,269
Scaffold, paper hanging, W. H. Root 714,520
Scale, measuring, H. Giles 714,172
Scale, platform, S. J. Austin 714,555
Screen. See Car window roller screen.
Sealing preserving jars, means for, W. Walter 714,539
Separator, C. W. A. Koelkebeck 714,381
Sewing machine, book, F. D. Taylor 714,531
Sewing machine, buttonhole, Dahl & Hill. 714,284
Shade cord fastener, G. G. Going 714,474
Shade rollers, mounting for vertically adjustable, A. A. Pease 714,230
Shaft or pole coupling, vehicle, J. Hearne .. 714,371
Shafting, means for attaching collars or pulleys to, D. L. Potter 714,605
Sheet metal handle, H. A. Keiner 714,584
Shelving, J. M. Lippincott 714,206
Ship coaling apparatus, F. V. Matton 714,499
Shoe, E. J. Bliss 714,439
Shoe fastening device, W. Becker 714,130
Shoulder brace and suspenders, combined, A. N. Johnson 714,307
Shovel clip, sheet metal, H. G. Sawyer 714,403
Sign illuminated by electric current, E. Plancon 714,233
Signal system, train, A. G. Davis 714,366
Siphon filling apparatus, L. Gansz 714,573
Slag, making basic, J. Reese 714,330
Sled, bob, J. H. Anderson 714,435

(Continued on page 384)

Apple Economical Gas Engine Igniters



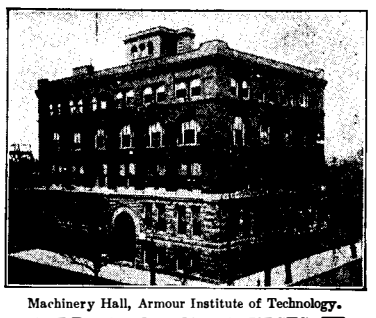
Are positively the best built for Stationary, Automobile and Marine Gas Engines, either touch or jump spark system. We are the leaders in the manufacture of Igniting Dynamos, Magnetos, Governors, Coils, Plugs, etc. Write for printed matter. **The Dayton Electrical Manf'g. Company,** No. 80 South St. Clair St., Dayton, Ohio, U. S. A.

New York stock carried by Chas. E. Miller, 97 Reade Street, N. Y.; Philadelphia Office, The Bourse; Chicago Office, 19-21 La Salle Street. St. Louis stock carried by A. L. Dyke, Limmar Building. Boston Stock carried by Electric Gas Lighting Co., 195 Devonshire Street, Boston, Mass. Dunham, Carrigan & Hayden Co., San Francisco, Distributing Agents for Pacific Coast.

BIG WAGES TO MEN and WOMEN

Mr. Tassell made $1,500 the first five months. Mr. Wise, of S. D., $12. 1st day. Mr. Clay, of Vt., $9 first day. Mr. Doerge, of Me., $10 one afternoon. Mr. Elliott, of Pa., $17 first two days. Mrs. Howard, of Ia., $59.50 in one week. Hundreds of others making big money selling and appointing agents for **Quaker Vapor Bath Cabinets.** Prices reduced. Let us start you. We furnish everything. Anyone willing to work can make $20 to $40 a week easy. Greatest money-maker known. Just what everybody needs. **Wonderful Seller.** We're old firm. Capital $100,000.00. **Write for New Plan, Terms, Etc., FREE.** Address, **WORLD M'F'G CO., 621 World Bldg., Cincinnati, O.**

ELECTRIC LAUNCH MOTOR.—THE design in this paper is for a motor of unusual simplicity of construction, which can easily be built by an amateur at small cost. It is intended for a boat of about 24 feet over all and 4 feet 6 inches beam, drawing 18 inches, and is capable of propelling such craft at a speed of 7 miles per hour. Illustrated with 21 cuts. See SCIENTIFIC AMERICAN SUPPLEMENT, No. **1202.** Price 10 cents by mail, from this office and from all newsdealers



Machinery Hall, Armour Institute of Technology.

CORRESPONDENCE COURSES IN

ENGINEERING

Electrical, Mechanical, Locomotive, Stationary, Marine and Sanitary Engineering; Navigation, Architecture, Mechanical and Perspective Drawing, Sheet Metal Work, Textile Manufacturing. Also 40 Short Special Engineering Courses.

INSTRUCTION UNDER MEMBERS OF FACULTY OF ARMOUR INSTITUTE OF TECHNOLOGY

Students are under the instruction of the very men who preside over the Laboratories and teach the classes of the Armour Institute of Technology. All work, therefore, will receive full credit toward resident work at Armour Institute, should the student at any time continue his studies there.

FOR EXAMPLE: Parts 1-6 of the work on Mechanical Drawing mastered under these auspices will be accepted as entrance preparation on that subject to the College of Engineering.

As a help in their studies, students in full Engineering courses are furnished a Technical Reference Library (in ten volumes), in addition to regular instruction papers. Catalogue sent upon request.

AMERICAN SCHOOL OF CORRESPONDENCE
At
Armour Institute of Technology
Mention Scientific American **Chicago, Ill.**

He's Giving Away a Fortune

A BOOK FOR EVERY HOME

A Masterpiece of Philanthropy by Hon. James R. Kenney, Ex-Mayor of Reading, Pa.

HON. JAMES R. KENNEY.

The Man Who is Giving Away a Fortune in Books.

Hon. James R. Kenney, ex-Mayor, is giving away a fortune in books. He is putting them right into the homes of the people absolutely without cost or trouble to them save the small trouble of writing. He has had prepared and printed the most remarkable work on personal magnetism, hypnotism and how to succeed in life, that has ever been written. It is brimful of intensely interesting and practical information. It is just what the young man needs who is starting in life to give him vim, push and energy; to make him magnetic, to enable him to overcome obstacles and surmount every difficulty to his success. It is just what the middle-aged man needs to enable him to win and hold friends, to become a leader in his community, to influence and sway the minds of his business associates and make his mark in life. It is just what every father and every mother needs to eradicate bad tempers and evil inclinations in children, to strengthen their moral faculties, and make them grow to be men and women, such as God intended they should be.

It is just what every minister of the Gospel needs to help him hold the wavering steadfast in their faith, to help him turn the minds of the wicked toward morality, honesty and right doing. It is just what every lawyer needs to help him influence juries, control witnesses and to deliver his argument in that forceful, convincing manner which carries conviction with every word. It is just what you need, no matter who you are or what you do, to enable you to get out of life the success, pleasure and happiness which the Creator intended should be yours. If you are not successful, if you are not making money, it is because you do not know that secret power that rules the thoughts and minds of men. If you are already successful you can become more successful if you will but master the hidden forces around you. Learn to use the secret magnetic power with which nature has endowed you.

Ex-Mayor Kenney's book proves everyone is born with this mighty subtle power, that anyone can easily develop it at home without the knowledge of his intimate friends or associates, and influence people secretly to carry out his thoughts and ideas. It certainly is a wonderful force, capable of infinite good.

"Hypnotism truly reveals the secret of life and the mysteries of nature," writes J. H. Schneller, 1412 Avon Street, La Crosse, Wis. "My own father could not have convinced me of its wonderful power if I had not actually tested it for myself. I consider a knowledge of it invaluable to those who wish to get the most out of life; to those who wish to achieve success and live up to the full measure of their possibilities."

J. R. Gaskins, Newport News, Va., writes: "I must admit that I doubted very much that hypnotism could be practically taught. In four days after receiving your work, however, you demonstrated to my entire satisfaction that I was never further from the truth in my life. I have met with wonderful success. Your free book is the finest thing of the kind I have ever seen."

A. C. Hyers, of Ithaca, N. Y., writes: "If any fault could be found with your instruction it would be that you give too much, thereby giving too many people the opportunity to acquire great secrets that have been guarded and known only by a very few for centuries—secrets that confer upon the possessor a wonderful power over their less informed friends."

Rev. John Lewelling, of Brownsville, Neb., writes: "You are engaged in a glorious work. I am applying your teachings every day. I congratulate you upon your work for suffering humanity."

Ex-Mayor Kenney ordered printed three months ago 19,000 copies of his new book for free distribution. The first copies are just now coming off the press. They are elegantly illustrated with the finest engravings and will prove a valuable addition to any library. If you would know all about hypnotism, the wonder science of the age, personal magnetism, thought force, and kindred sciences, write for a free copy of this remarkable book at once. It will be sent to your address postage prepaid. You will be delighted, mystified and benefitted more than words can tell. Nothing like it has ever before been printed. Ex-Mayor Kenney is giving them away for the benefit of the public. He belives by doing so he is accomplishing more good than by donating his money to hospitals, public libraries or anything of this nature. He gives you a book worth more to a young man than a college education. He gives it to you for your own personal use, to keep in your library or to carry with you. On account of the great expense in preparing and printing this book only those are requested to write who are especially intrested in bettering themselves in life and who actually wish to make practical use of the information given in the book.

If you want a free copy write at once to L. C. Bauers, secretary to ex-Mayor Kenney, office S H 7, 420 Walnut Street, Philadelphia, Pa.

© 1902 SCIENTIFIC AMERICAN, INC.

NOTICE!

to Scientists, Mechanics and All Thinking People. YOU will be highly interested in a new invention just patented. An absolutely new principle in developing intense rotary motion, which is being applied to the Greatest and most Fascinating Novelty in the world to-day. A Regular Scientific Paradox. For extensively illustrated descriptive matter of this "MECHANICAL WIZARD" address

WIZARD NOVELTY COMPANY,
1845 Cherry St., Philadelphia, Pa., U. S. A.

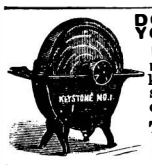
SPECIFY in your specifications for traps, columns, receivers, low-water alarms, etc., the

HERCULES SEAMLESS FLOATS

The only genuine; all others are imitations.

HERCULES FLOAT WORKS,
Box 372,
Springfield, Mass.

Removed to 182 Milk Street.



DO YOU USE GRINDSTONES?

If so we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. Ask for catalogue

The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

ART CALENDAR

Four graceful poses from life; figures ten inches high, reproduced in colors. Highest example of lithographic art.

"THE ONLY WAY"

to own one of these beautiful calendars is to send twenty-five cents, with name of publication in which you read this advertisement, to GEO. J. CHARLTON, General Passenger Agent, Chicago & Alton Railway, 328 Monadnock Building, CHICAGO, ILL.

The best railway line between CHICAGO, ST. LOUIS, KANSAS CITY and PEORIA.

MATCH FACTORY.—DESCRIPTION of an English factory. SCIENTIFIC AMERICAN SUPPLEMENT 1113. Price 10 cents. For sale by Munn & Co. and all newsdealers.

TOOLS AS A TOPIC

must be interesting to every handicraftsman. There is a mine of information in

Montgomery & Co.'s Tool Catalogue

which enumerates thousands of tools. Capital handbook of reference. Profusely illustrated. Sent by mail for 25 cents, discount sheet included.

MONTGOMERY & CO.,
105 Fulton St., New York City.

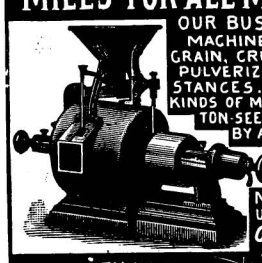
The WOODEN HEN

A high-class self-regulating incubator on a small scale. Fifty egg capacity. Heat, moisture and ventilation automatically and perfectly controlled. Price only $6.80.

Send for the Wooden Hen Book; mailed free, together with a book containing 14 colored views and telling all about the EXCELSIOR INCUBATOR, if you name this paper.

GEO. H. STAHL, Quincy, Illinois.

MILLS FOR ALL MATERIALS.



OUR BUSINESS IS TO MAKE MACHINERY FOR GRINDING GRAIN, CRUSHING ROCKS AND PULVERIZING ALL HARD SUBSTANCES. WE HANDLE ALL KINDS OF MATERIALS FROM COTTON-SEED TO ROOTS AND HERBS, BY AN UNEXCELLED PROCESS. IF YOU WANT ANY KIND OF A MILL OR GRINDING MACHINE, COME TO US AND YOU WILL GET THE BEST AND STILL SAVE MONEY.

DEAL WITH US ONCE AND YOU WONT CHANGE.
ESTIMATES FREELY FURNISHED.
SPROUT, WALDRON & CO.
SEND FOR CATALOG No 4) MUNCY, PA.

Sleigh attachment, bob, R. McArthur..... 714,389
Smoke conductor, D. L. Potter..... 714,606
Smoke consuming apparatus, furnace, A. Anderson 714,434
Sounds, recording and reproducing, T. H. Macdonald 714,651
Spectacles, F. Schick 714,522
Spike puller, G. Smith..... 714,250
Spoke chipping machine, R. L. Notman.... 714,227
Sponge, protected, J. Williams..... 714,626
Spout and faucet, A. J. Ketelsen..... 714,585
Spring, M. H. Naber 714,225
Stacker fan, pneumatic, J. K. Sharpe, Jr., 714,525, 714,526
Stamp affixer, J. R. Turner..... 714,536
Stamping or punching tool, W. Neuendorff 714,602
Stay, garment, R. Herzog..... 714,372
Steam boiler, C. M. Raymond..... 714,237
Steam boiler, water tube, P. J. Sweeney.. 714,530
Steam generator, J. T. Plenty..... 714,234
Steam trap, D. Murdock..... 714,509
Steel, high tungsten, G. B. Brown..... 714,139
Stiffening strips, substitute for whalebone, A. M. Weber 714,541
Still, Warren & Healy..... 714,339
Storage battery, S. Laszczynski..... 714,201
Stove, open fireplace, J. K. Ross..... 714,399
Stovepipe, J. Wylie 714,629
Strength testing machine, H. Haenze..... 714,477
Switch operating device, O. McNorton, Jr.. 714,392
Sword, trick, W. Thomas 714,534
Tank cover, A. Giesler 714,296
Tanning hides, pelts, etc., solution for, O. P. Amend 714,433
Tap hole plug, A. Dickey 714,159
Telegraphers' keys, etc., button for, H. J. Greule 714,299
Telegraphic messages over a single wire, apparatus for simultaneously transmitting a number of, J. Ziegler 714,630
Telegraphic or telautographic apparatus, E. K. Gruhn 714,577
Telegraphy, wireless, H. Shoemaker, 714,246, 714,248
Telephone switch, J. A. Warrick 714,540
Telephones, telegraphs, etc., traveling contact for railway, A. D. Jones..... 714,189
Thill coupling, R. Eccles 714,163
Thill coupling, W. A. Buchanan 714,634
Ticket issuing, recording, and printing machine, Ohmer & Kelly..... 714,228
Tie. See Railway tie.
Time sheet, O. Johnson 714,188
Tire and rim, vehicle, F. G. Saylor..... 714,333
Tire, pneumatic, W. Edmund..... 714,164
Tires, means for tightening wires in elastic, J. E. Sprague..... 714,528
Toilet article handle, R. R. Debacher.... 714,460
Tongs, pipe, W. Maxwell..... 714,387
Tongue attachment, R. C. Thompson..... 714,261
Tool handle, motor, G. H. Hillyer..... 714,581
Toy, spirometer, H. G. Cady..... 714,141
Tramway lines, mechanism for shifting points of, G. D. Ross..... 714,398
Tramway switch, automatic, J. Hilmar.... 714,301
Transformer, inductor, etc., F. Pichler.... 714,232
Trap, E. M. Nichols..... 714,323
Treenail billets, etc., machine for turning, A. Collet 714,282
Trolley, J. Morgan 714,506
Trolley guard, C. O. Prince 714,608
Trolley harp contact, J. H. Walker..... 714,268
Trolley pole harp, J. H. Walker..... 714,267
Trolley wheel, J. B. Lockerby..... 714,589
Trowel, plasterer's, F. T. McFall..... 714,223
Truck, hand, E. J. Bryan 714,140
Truss, hernial, G. R. House..... 714,305
Tufting machine, Borgwardt & Consoer... 714,441
Tunnel construction, G. Lindenthal..... 714,204
Tunnels, laying, G. Lindenthal..... 714,205
Turbine, steam, R. Wilson..... 714,627
Type for typewriting or printing, Tcherkassov & Hill 714,621
Typewriter, C. Spiro 714,252
Typewriting machine, H. Jarvis 714,186
Typewriting machine attachment, W. C. Black 714,132
Typewriting machine spacing mechanism, Schlesinger & Young 714,523
Universal joint, R. W. Pittman..... 714,327
Universal union or coupling, G. S. Lee.... 714,311
Valve, C. H. Stainton et al..... 714,410
Valve, air compressor relief, A. Giesler. 714,295
Valve and packing, plunger, T. Grant.... 714,298
Valve, combined vacuum relief, Whelan & Sweigard 714,345
Valve gear, fluid pressure engine, J. T. Marshall 714,213
Valve, pressure reducing, S. Carlson..... 714,143
Vapors, apparatus for disposing of foul, E. R. Edson 714,165
Vehicle, drop body, A. P. Bowman..... 714,135
Vehicle speed regulating mechanism, motor, Scognamillo & Posner 714,614
Vehicle spring, E. F. Gehman..... 714,574
Vehicle top spring padding, R. A. Keller.. 714,190
Vehicle wheel, J. M. Alderfer..... 714,271
Vending machine, E. Shaw..... 714,615
Vessel support, A. P. Hallock..... 714,479
Veterinary speculum, R. J. Fleming..... 714,369
Vise, pipe, J. R. Long..... 714,208
Wage statement and pay envelope, employee's, J. T. Dixon 714,462
Wagon, M. Tidd 714,535
Wagon, dump, J. W. Haywood..714,481 to 714,483
Wagon, dumping, J. B. Rhodes 714,239
Wagon, dumping, J. F. Day..... 714,286
Wagon jack, J. F. White 714,346
Wagon running gear, A. M. Cushing..... 714,563
Watch fob safety attachment, C. P. Keeler 714,379
Water gate, F. E. Adams..... 714,551
Water heater, H. Anderson..... 714,354
Water heater, J. M. Fox..... 714,641
Water heater and steam generator, instantaneous combined, D. E. Hurd.... 714,183
Water heating apparatus, J. B. Hall..... 714,478
Watering cart sprinkler head, E. D. Eastman 714,566
Wave and tide motor, H. C. Essington.... 714,166
Wearing articles to each other, device for connecting, Mergenthaler & Selkirk... 714,317
Weeder, G. E. Champlin..... 714,280
Well head, oil, F. J. Moser..... 714,508
Wells from gushing, etc., device for preventing gas or oil, G. R. Cheeseman.. 714,146
Wheel, W. C. Morton..... 714,221
Wheel gage, J. Demarty 714,367
Whiffletree, J. Watts 714,341
Window frame and sash, metallic, H. A. Streeter 714,254
Window screen, H. L. Roberts 714,519
Wire ends, machine for forming loops on, H. Wilson 714,426
Wire working machine feeding device, T. S. Haley 714,175
Wood preserving compound, C. Schallberger 714,521
Zinc for zinc skimmings, extracting, H. C. Meister 714,502, 714,503

DESIGNS.

Spoon, F. W. Colwell..... 36,147
Stove, C. H. Fleming..... 36,148

TRADE MARKS.

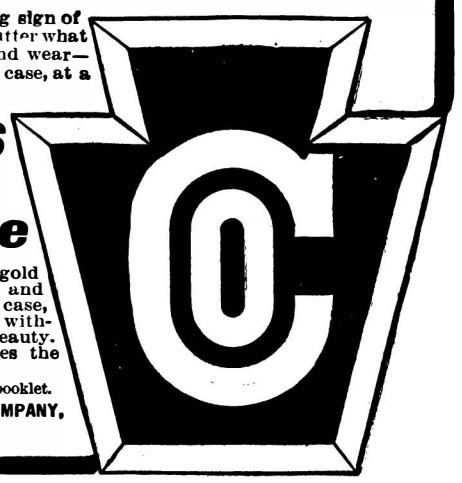
Beer, Joplin Brewing Co..... 39,344
Bitters, alcoholic, C. H. Struebe..... 39,349
Candy, Ward & Stickles..... 39,336
Cheese, J. du Parc..... 39,335
Clippers, barbers', Contes Clipper Mfg. Co.. 39,363
Clothing certain named, H. Ambach..... 39,352
Coffee, Arbuckle Bros..... 39,334
Coffee, Merchants Coffee Co..... 39,339
Exercising devices, elastic, Paraco Rubber Co. 39,361
Fire crackers, R. Brauss..... 39,364
Flour, wheat, Washburn Crosby Co...39,328, 39,329
Food products, cereal, Igleheart Brothers.. 39,333
Food products, certain named, Berdan & Co., 39,330, 39,331
Glass, certain named, Belgian Plate & Window Glass Co..... 39,366
Hats, C. C. Settle 39,354
Hats and caps, Marks & Fader..... 39,355

(Continued on page 385)

The Sign of a Watch Case

This Keystone is the identifying sign of the best watch case made—no matter what it costs. It stands for worth and wear—for beauty equal to an all-gold case, at a much smaller price. The

JAS. BOSS Stiffened GOLD Watch Case



is better protection than a solid gold case, because of its stiffness and strength. Better than any other case, because it will last for 25 years without wearing *thin* or losing its beauty. A reputation of 50 years proves the value of the Jas. Boss Case.

Consult the jeweler. Write us for a booklet.

THE KEYSTONE WATCH CASE COMPANY,
Philadelphia.

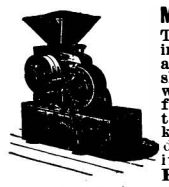
SYNCHRONOGRAPH.—A NEW METHOD of rapidly transmitting intelligence by the alternating current. A full description of the interesting apparatus of Crehore and Squier. 13 illustrations. SCIENTIFIC AMERICAN SUPPLEMENTS 1114 and 1115. Price 10 cents each. For sale by Munn & Co. and all newsdealers. Send for new catalogue.

A DESIRABLE HOLIDAY GIFT
DRAPER'S
Recording Thermometer

Traces automatically a correct and continuous record in ink of the temperature on a graduated weekly chart. Standardized and fully guaranteed. Also other recording weather instruments.

THE DRAPER MFG. CO.
152 Front St., New York

REVERSING STEAM TURBINE.—PARSON'S recently perfected turbine for boats. Illustrations showing details. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1158. Price 10 cents, by mail, from this office, and from all newsdealers.



MAGNETIC Metal Separator

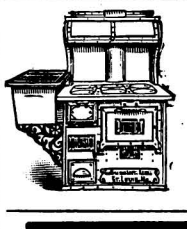
The best contrivance for separating iron turnings, filings, etc., from brass and other materials. Cylinder shown in cut has 300 magnets to which the iron adheres, separating it from all other particles. Brass stock thus cleaned can be used for best kind of work. 3 sizes. 1,500 to 4,000 daily capacity and upwards. In use in the leading factories. Manuf'd by Ezra Sawyer, Worcester, Mass.

ELECTRICAL APPARATUS REPRESENTED by Conventional Diagrams in Drawings.—Fifty diagrams showing the usual method of illustrating electrical apparatus in drawings. A labor saving paper. Contained in SUPPPEMENT 1106. Price 10 cents. For sale by Munn & Co. and all newsdealers.

BEST REPEATING SHOT GUN ONLY $15.75

Sportsmen write: "Spencer best gun in the world." No more after present lot sold. Original slide lever gun made of best forged steel, finest figured twist steel barrel. Double extractors. Take down system. Six shots in 3 seconds. Strongest repeater made." Send $5; gun sent C. O. D., balance $10.75 and expressage; examination allowed. F. Bannerman, 579 Broadway, N.Y.

NEW CATALOGUE ELEVATING = CONVEYING MACHINERY
NOW READY SEND FOR COPY
THE JEFFREY MFG. CO. COLUMBUS, O. U.S.A.



I will Ship to any Station in the United States for
THE CELEBRATED
WILLARD STEEL RANGE $25.00

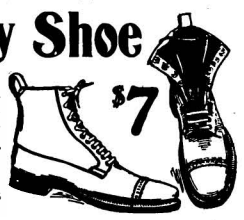
It has six 8-inch lids; 15-gallon reservoir; large warming closet; oven 21 ins. deep, 17 ins. wide, 12 ins. high; top cooking surface, 30x36 ins.; lined throughout with Asbestos; Duplex grate; burns wood or coal. Guaranteed in every repect; weighs 400 lbs. Write for free descriptive circular and testimonials. AGENTS WANTED.

WM. G. WILLARD, Dept. 112, 619-21 N. 4th Street, St. Louis, Mo.

CALIFORNIA
Reliable Information
about orange growing, fruit culture, vegetable gardening, grain growing, poultry, climate, soil, water, lands, power, markets, manufacturing facilities, wages, etc.
For printed matter and other information write
CALIFORNIA PROMOTION COMMITTEE
REPRESENTING STATE COMMERCIAL ORGANIZATIONS
Dept. K. K. 25 New Montgomery St.,
SAN FRANCISCO, CALIFORNIA

University Shoe

(Trade-Mark)



Heaviest oily grain leather—tan colored or black. Watertight construction. Comfortable and nearly indestructible. Send for pamphlet.

J. P. TWADDELL
1210-1212 Market Street
Philadelphia

WIRELESS TELEGRAPHY.—SCIENTIFIC AMERICAN SUPPLEMENT Nos. 1213, 1327, 1328 and 1329, contain illustrated articles on this subject by G. Marconi. Additional illustrated articles by other authors are contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos. 1124, 1131, 1177, 1192, 1217, 1218, 1219 and 1304. These papers constitute a valuable treatise on wireless telegraphy. Price 10 cents each from this office, and all newsdealers.

BRIGHT AS THE SUN

About as cheap as air.

"SUN" Incandescent Gasoline Lamp

Ideal Light for home, hall, church or business. Conforms to insurance underwriters' rulings. Branch supply depots in all larger cities. Write for catalogue.

AGENTS SECURE TERRITORY.

Sun Vapor Light Co.
Box 605, Canton, O.
(Licensee of the ground patents for vapor lamps.)

BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT 1123. Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for catalogue.

SPECIAL INSTALLMENT OFFER

$1.00 *in advance and $1.00 a month for four months will obtain . . .*

Judge, one year, or
Leslie's Weekly, one year,
} and your choice of either the **Memorial War Book** or **Caricature**

We offer A YEAR'S SUBSCRIPTION TO EITHER **Judge or Leslie's Weekly**, TOGETHER WITH **The Memorial War Book** (a book of 600 pages and 2,000 illustrations), or **Caricature** (a book of 250 pages and illustrations in color and in black and white), each book being fully described in the accompanying circular, for only **$1 00 with the order** and **$1.00 per month** for four months, or $5.00 cash with order. Mail this coupon to us with only ONE DOLLAR, and we will send prepaid your choice of the books and enter your subscription to either JUDGE or LESLIE'S WEEKLY, as you may select.

THE JUDGE COMPANY, 110 Fifth Avenue, New York

I accept your offer of The Memorial War Book or Caricature, and Judge or Leslie's Weekly for one year. Enclosed find $1.00 for first payment. $1.00 to be remitted by me for four months, $5.00 in all.

Indicate which book and which paper is desired by running your pen through the name of that not desired.

NAME.....

ADDRESS.....

© 1902 SCIENTIFIC AMERICAN, INC.

Thallner's Tool-Steel.

Indispensable to All Tool Makers and Tool Users.

JUST READY.

Tool-Steel: A Concise Hand-Book on Tool-Steel in General; Its Treatment in the Operations of Forging, Annealing, Hardening, Tempering, etc., and the Appliances therefor. By Otto Thallner, Head-master and Manager in Chief of the Tool-Steel Works. Bismarckhutte on the Saale, Germany. Authorized Translation from the German by William T. Brannt. Illustrated by 69 engravings. 196 Pages, 8vo.

☞ *Price $2.00, free of postage to any address in the world.*

☞ *The above or any of our Books sent by mail, free of postage, at the publication price, to any address in the world.*

☞ *An Illustrated Circular of 5 pages, quarto, giving the full Table of Contents of this important book, will be sent free of postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS,
810 Walnut St., Philadelphia, Pa., U. S. A.

A Secure Position

is yours, if you are properly trained. What manufacturers and business men are calling for every day are trained men. Our booklet "How to Earn More," contains interesting facts and helpful information. Send for a copy. IT'S FREE. Our courses for home study include

Engineering, Illustrating,
Architecture, Decorating,
Mining, Journalism,
Metallurgy, Bookkeeping,
Art, Stenography,
and English Branches.

SEND FOR CATALOGUE 6.

THE CONSOLIDATED SCHOOLS,
156 Fifth Ave., New York.

ELECTRICAL ENGINEERING TAUGHT BY MAIL.

Write for our Free Illustrated Book.
"CAN I BECOME AN ELECTRICAL ENGINEER?"

We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Steam Engineering, Mechanical Drawing, at your home by mail. Institute indorsed by Thos. A. Edison and others.
ELECTRICAL ENGINEER INSTITUTE,
Dept. A, 240-242 W. 23d St. New York.

Chicago-New York

20

Hours.

On the basis that "Time is money," the use of the "20th Century Limited" over the Lake Shore & Michigan Southern Railway will prove a money earner for its patrons.

Runs daily, in each direction between Chicago and New York in twenty hours, via

Lake Shore
and Michigan Southern Ry.

and New York Central. A train for busy people.

Saves an entire business day.

Five sumptuous cars furnishing all the conveniences of the leading hotels.

Send for copy of "Some Privileges for Lake Shore Patrons" and "Book of Trains," containing useful matter for travelers.

A. J. SMITH, G.P.&T.A., Cleveland, O.

Be Your Own Printer

and print for your friends and acquaintances. Our MODEL PRINTING PRESS at a comparatively small cost, puts a sure source of income in your hands. Work at odd moments can be made profitable. Easily learned and operated. Prints from a businesscard to a small newspaper. The Model Printing Press, Dept. B, 708 Chestnut St., Philadelphia, Pa.

50 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &C.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, New York
Branch Office, 625 F St., Washington, D. C.

Hats and caps, soft and stiff felt, John B. Stetson Company 39,368
Insulating materials, Minerallac Company .. 39,362
Lard and lard compounds, Cudahy Packing Co. 39,338
Laxative, Pascoe Medicine Co. 39,345
Liver stimulant and tonic, R. A. Rowlinski. 39,351
Medicinal tablets for certain named diseases, Piso Company 39,346
Paint, varnishes, and paint oils, Ironsides Company 39,365
Pharmaceutical preparations for certain named diseases, Brigonnet Pere & Fils & Gaubert 39,347
Pharmaceutical products for certain named purposes, Actien Gesellschaft fur Anilin Fabrikation 39,367
Remedy for car sickness, Kar & Sea Sic Co., 39,350, 39,348
Rusk, Karl Digestible Rusk Co. 39,332
Shoes, leather, Friedman Bros. Shoe Co. 39,353
Syrup, sugar syrups, and molasses, maple, Berdan & Co. 39,340, 39,341
Tin and terne plates, American Tin Plate Co. .....39,356 to 39,359
Whisky, Scotch, Marshall, McEwen & Co... 39,343

LABELS.

"Buchanan Blend," for Scotch whisky, J. Buchanan 9,574
"Cefalu Sicilia," for olive oil, Olive Oil Importing Co. 9,578
"Chase's Formosa Oolong Tea," for tea, Milliken, Tomlinson Co. 9,576
"De Laney Bros. Egg and Pine Tar Liquid Shampoo," for a shampoo, J. H. De Laney 9,568
"Duluth Fashion," for cigars, Duluth Cigar Co. 9,573
"Elixir Lifoline Compound," for an elixir, Lifoline Chemical Co. 9,570
"Energy," for medicated food, J. H. Brown. 9,577
"Engel's Gem Cleaner," for a cleaner, A. W. Engel 9,579
"Erdman's German Herb Cure," for medicine, Erdman & Co. 9,569
"Lifoline," for medicine, Lifoline Chemical Co. 9,566
"Mineral Turpentine," for mineral turpentine, Great Western Oil Co. 9,580
"Oatine," for a facial preparation, F. M. Carroll 9,567
"Plantation," for cigars, Schmidt & Co..... 9,572
"Shefford Brand," for potted cream cheese, Shefford Cheese Co. 9,575
"Stewart's Sure Cure for Horses and Cattle," for horse and cattle remedies, J. Strohauer 9,571

PRINTS.

"Men's Apparel," for men's apparel, W. C. Both 579
"Omar Coffee," for coffee, H. W. Dudley & Co. 578
"Owl Cigar 5c.," for cigars, United Cigar Manufacturers 577

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

NEW BOOKS, ETC.

INDUCTION COILS FOR AMATEURS. How to Make and Use Them. Edited by Percival Marshall, A.I., M.E. London: Dawbarn & Ward, Ltd. 16mo. Pp. 70 Paper, 25 cents.

This is a serviceable little book which describes in clear terms a piece of apparatus that has always been popular with amateurs and students.

A CLASSIFIED LIST OF MINERALS, PRECIOUS AND OTHER STONES. By Felix J. Troughton. The Abbey Press, New York. Pp. 27. Price 50 cents.

The author has endeavored, so he tells us, to include every known mineral and precious stone in his book. To those interested in mineralogy the work is primarily intended, and much valuable information on matters of this kind will doubtless be found therein.

DEVELOPMENT AND EVOLUTION. By James Mark Baldwin, New York: The Macmillan Company. London: Macmillan & Co., Ltd. 1902. 16mo. Pp. xvi, 395. Price, $2.60.

Professor Baldwin assures us in his preface that his work fulfills in a general way the intention expressed in "Social and Ethical Interpretations" of taking up some of the biological problems most closely connected with psychological ones and falling under the general scope of the genetic method. The theories outlined have been promulgated partly by Professor Baldwin and partly by Professor Osborne and Lloyd Morgan. The work thus becomes a kind of handbook of the theory of orthoplasy so far as the combined work of Professor Baldwin and other men are concerned. On the other hand, those portions which are due to Professor Baldwin alone contain expositions of "psychophysical evolution" and an outline of the "theory of genetic modes."

ARCHITECTURAL DRAWING. By R. Phené Spiers, F.S.A., Architect. Cassell & Co., Ltd., New York, London, Paris and Melbourne. 1892. 8vo. Pp. 67.

This book is the outcome of a paper read by the author at a meeting of the Architectural Association in 1874. The author has endeavored to place himself in relation with the requirements of English office training of the present day, and to point how, concurrently with office work, the architectural pupil may turn to the best account opportunities for private study. The book tells what it has to tell in a lucid style. The illustrations are numerous and serviceable.

THE BLAST FURNACE AS A POWER PRODUCER. Data relating to this and Allied Subjects. Edited by B. H. Thwaite, C. E., F. C. S., and Horace Allen, C. E. London, 1898. Pp. 36.

PERFORATED METALS
OF EVERY DESCRIPTION AND FOR ALL USES.
THE HARRINGTON & KING PERFORATING CO.
225 N. UNION ST. CHICAGO, ILL. U.S.A.

TUBULAR DRIVING LAMP.

IT is the only perfect one.
IT will not blow or jar out.
IT gives a clear, white light.
IT is like an engine headlight.
IT throws the light straight ahead from 200 to 300 ft.
IT burns kerosene,
Send for book (free).

R. E. DIETZ CO., 60 Laight Street, New York.
Mention this paper and get special discount.
—ESTABLISHED 1840.—

THE COUNTRY GENTLEMAN

ESTABLISHED 1831

The ONLY Agricultural NEWSpaper,
AND ADMITTEDLY THE
Leading Agricultural Journal of the World.

Every department written by specialists, the highest authorities in their respective lines.

No other paper pretends to compare with it in qualifications of editorial staff.

Gives the agricultural NEWS with a degree of completeness not even attempted by others.

INDISPENSABLE TO
ALL COUNTRY RESIDENTS
WHO WISH TO
KEEP UP WITH THE TIMES.

Single Subscription, $1.50;
Two Subscriptions, $2.50;
Five Subscriptions, $5.50.

SPECIAL INDUCEMENTS to RAISERS OF LARGER CLUBS.

Four Months' Trial Trip 50 cents.

SPECIMEN COPIES

will be mailed free on request. It will pay anybody interested in any way in country life to send for them. Address the publishers:

LUTHER TUCKER & SON,
Albany, N. Y.

☞ Subscriptions taken at this office.

EVOLUTION OF THE AMERICAN LOCOMOTIVE.—By Herbert T. Walker. A valuable series by a member of the National Railway Museum Committee. The locomotive from 1825 to date is described and illustrated by careful drawings, great attention being given to historical accuracy. 21 illustrations. SCIENTIFIC AMERICAN SUPPLEMENTS 1112, 1113, 1114. Price 10 cents each. For sale by Munn & Co. and all newsdealers.

$7.50 for 5-SHOT SOUVENIR MAUSER RIFLE

Unplanned at Santiago; relic only; parts missing. $10.00 for serviceable gun with box etgs. $12.50 for gun like new with sporting model stock and box etgs. Mausers are the best high-power rifle made. Range 2 miles, penetration through ¾ inch iron. Send $4.50; gun sent C.O.D. for balance and expressage; examination allowed. 5,000,000 Cartridges, $2.25 per 1,000. Discount for Export Orders. F. BANNERMAN, 579 Broadway, New York.

H. A. KAYSAN- Cassel, Germany
Importer of American Specialties
Manufacturers will kindly quote prices and mail samples

A MONEY MAKING METAL WORKING AND STAMPING PLANT FOR SALE.
Orders easy to get and at good prices. Good specialties and ready customers for them. Capable of great expansion, and profits will pay at a rapid rate for all additions and improvements. Special reasons for selling. Price $25,000. Address Box 156, Niagara Falls, N. Y.

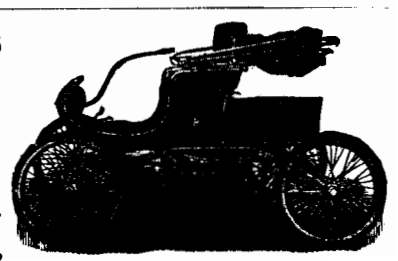
I Can Sell Your Real Estate
no matter where it is. Send description, state price and learn how. Est. '96. Highest references. Offices in 14 cities.
W. M. Ostrander, 1893 N. A. Bldg., Philadelphia

I PRINT MY OWN CARDS
Circulars, newspaper. Press, $5. Larger size, $18.00. Money Saver. Big profits printing for others. Type setting easy, rules sent. Write for catalog, presses, type, paper, etc., to factory, The Press Co., Meriden, Conn.

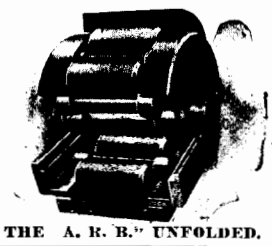
SECTORLESS WIMSHURST MACHINE.—This article gives directions for making. 4 illustrations. SCIENTIFIC AMERICAN SUPPLEMENT 1131. Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for new catalogue.

The Franklin Gas Engine
One-Half Horse Power
Worth $100 complete. We sell all necessary castings, materials and detail drawings for $16.50. For real work—not a toy. 450 revolutions per minute. Upright or horizontal form. Finished parts sold separately. Runs by gas or gasolene. For boys and men with a mechanical turn. Write for circular 9.
PARSELL & WEED,
129-131 West 31st St., New York.

The Best Thing on Wheels
ALL ROADS ARE ALIKE TO
The OLDSMOBILE
RUNS EVERYWHERE
Nothing to Watch but the Road Ahead.
Our new red catalog illustrates and describes it in detail.
THE PRICE IS RIGHT
OLDS MOTOR WORKS, DETROIT, MICH.



TOOLS
FOR MECHANICS.
Send for Free Catalogue No. 16 B.
The L. S. Starrett Co., Athol, Mass., U. S. A.


THE A. R. B." UNFOLDED.

This is a ROLLER BEARING
Not a GRINDING Machine
Every PART Rolls.
Plain bearings and caged roller bearings rub and grind. Send for circular.
American Roller Bearing Co., 32 Binford St., BOSTON, MASS.
K. FRANKLIN PETERSON, 165 Lake St., Chicago, Ill Gen. Mgr. Western Dept'

A. W. FABER
Manufactory Established 1761.
LEAD PENCILS, COLORED PENCILS, SLATE PENCILS, WRITING SLATES, INKS, STATIONERS RUBBER GOODS, RULERS, ARTISTS' COLORS.
78 Reade Street, New York, N. Y.
GRAND PRIZE, Highest Award, PARIS, 1900.

THE MOST MODERN AUTO
ELMORE AUTOMOBILES.

Practical, Durable Efficient. Easy to control at any speed. Double cylinder motor, smooth gliding motion. 2 models, $800-$1500. Get further information free.
ELMORE MANUFACTURING CO., Clyde, O., U. S. A.

EVANS
VacuumCap
This appliance will massage the scalp and increase circulation without rubbing or irritation. It will stop hair from falling out, encourages a healthful growth and is guaranteed to give satisfaction. Address
EVANS VACUUM CAP CO.,
Fullerton Bldg. St. Louis, Mo.

MODELS & EXPERIMENTAL WORK.
Inventions developed. Special Machinery.
E. V. BAILLARD, Fox Bldg., Franklin Square, New York.

Latest Moving Picture Machines. No vibration. New Spectacular effects, etc. Booklet "Projection Optics," free. Bullard & Breck, 131 Post, San Francisco, Cal.

STEEL TYPEWRITER CASES
TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

Experimental & Model Work
Cir. & advice free. Wm. Gardam & Son, 45-51 Rose St., N.Y.

ELECTRICITY. HOW TO MAKE. 10 Cts.
A Dynamo. Storage Battery, Wimshurst Machine, Telegraph Instrument, Electric Bell, 5 Books, 10 cents each.
Bubier Pub. Co., Box S, Lynn, Mass.

MODELS CHICAGO MODEL WORKS
ESTABLISHED 1867 179 E. MADISON ST. CHICAGO, ILL.
WRITE FOR CATALOGUE OF MODELS & SUPPLIES.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee Wis.

AGENTS WANTED In every county in the State to sell Transparent Handle Pocket Knives. Good commissions paid. From $75 to $300 a month easily made. Write for terms. Novelty Cutlery Co., 2 Bar St., Canton, O

DRYING MACHINES. S. E. WORRELL, Hannibal, Mo.

MATCH Factory Machinery. W. E. WILLIAMS, Mfr., 217 South Clinton St., Chicago, U. S. A.

Cement Books. How to Use Portland Cement, 50c.; Monier Cement & Steel, 50c. Cement and Engineering News, 162 La Salle St., Chicago

Magical Apparatus.
Grand Book Catalogue. Over 700 engravings, 25c. Parlor Tricks Catalogue, free.
MARTINKA & CO., Mfrs., 493 Sixth Ave., New York.

"THIS BEATS NEW JERSEY."
Charters procured under South Dakota laws for a few dollars. Write for Corporation laws, blanks, by-laws and forms to PHILIP LAWRENCE, late Ass't Secretary of State, Huron, South Dakota, or 220 B'way, 20th K, New York.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches & Elevators
PROVIDENCE, R. I.

NOVELTIES & PATENTED ARTICLES
Manufactured by Contract. Punching Dies, Special Machinery. E. Konigslow & Bro., 181 Seneca St. Cleveland, O.

SPECIAL MANUFACTURING, SPEC. MACHINERY, MODELS, EXPERIMENTAL WORK, DIES AND STAMPING. PROMPT. GLOBE MACH. & STAMPING CO. 970 HAMILTON ST. CLEVELAND, O.

© 1902 SCIENTIFIC AMERICAN, INC.

THOROUGH INSPECTIONS AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY STEAM BOILER EXPLOSIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

J. M. ALLEN · PRESIDENT · W. B. FRANKLIN · VICE PRESIDENT
J. B. PIERCE · SECRETARY · F. B. ALLEN · 2ND VICE PRESIDENT
L. B. BRAINERD, TREAS. · L. F. MIDDLEBROOK, ASST SEC'Y

THE NEW WINTON

Beyond question the most luxuricus and complete high grade automobile ever manufactured in America.

It will be in the hands of agents and at our branch depots in a very few weeks. Twenty H. P. motor, new body design, etc.

If interested in knowing more, write us.

THE WINTON MOTOR CARRIAGE CO.,
Factory and General Offices, CLEVELAND, O., U.S.A.
NEW YORK CHICAGO BOSTON PHILADELPHIA

DYKE TONNEAU
We sell the parts for you to build. Everything from an Auto. Cap to a complete machine. Send stamp for 50-page Catalogue.
A. L. Dyke, ST. LOUIS, MO., (Originator First Auto. Supply Business in America.)

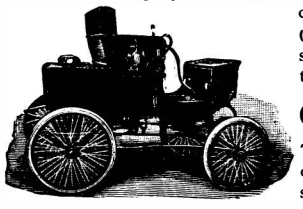
JUST READY.
SECOND WONDER
(TRADE MARK.)
"A step forward in Acetylene Burners."
STATE LINE MFG. CO., 107 Chambers St., New York; 57 Washington St., Chicago; Chattanooga, U. S. A. Sample mailed for 25 cents.

Gas Engine IGNITER

Complete with spark coil, $12.00. The Best Thing on the market. Latest and most improved model.
☞ Send for Circular.
Carlisle & Finch Co., 233 E. Clifton Av., Cincinnati, O.

"AGAIN VICTORIOUS"

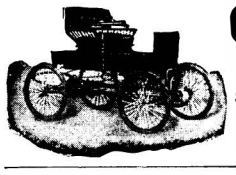
All three carriages entered were **Blue Ribbon Winners.** Eighty entries, twenty qualified for cup, ten of these (or one-half) were steam, and two of these were



GROUTS.

Third stopped only once for slight adjustment.

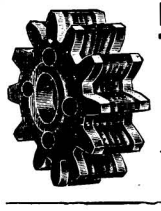
GROUT BROS.
Steam Carriage Makers Orange, Mass.



Crestmobile
PRICE $600
Speed and Comfort
CREST MFG. CO.,
Cambridge, Mass.

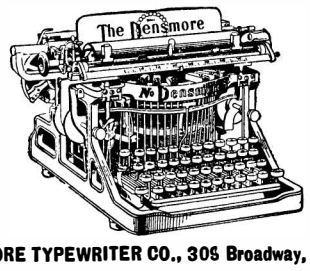
$750
HYDRO-CARBON.
20-Mile Speed.
20 per cent. Grades.
100-Mile Gasoline Tank.
300-Mile Water Tank.
900 lbs. 6 H. P. Actual.
Write for Catalogue.

FRIEDMAN AUTOMOBILE CO.,
8 E. Van Buren Street, Chicago, Ill.

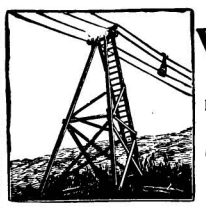


Rawhide Pinions and Accurate Metal Gears
Can furnish anything in this line. Get our prices
THE NEW PROCESS RAWHIDE CO.
Syracuse, N. Y.

That Densmore Touch Pleases.



DENSMORE TYPEWRITER CO., 309 Broadway, New York

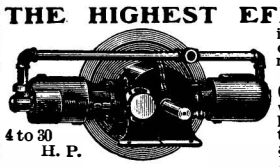


PATENT AERIAL
WIRE ROPE TRAMWAY
HERCULES WIRE ROPE (Trade Mark Registered.)
For Transportation of Ore, Coal, Dirt, Timber, etc.
Perfect Grip Clip. Absolutely Safe. Loads Automatically. Unloads Automatically.
Operated by One Man. Cost of Maintenance Low. Capacity Largest Obtainable.
A. LESCHEN & SONS ROPE COMPANY. Home Office, 920-922 North Main Street, St. Louis, Mo.
Branch Offices, 92 Centre Street, New York City, N. Y. / 137 E. Lake Street, Chicago, Ill. / 85 Fremont Street, San Francisco, Cal.

....TO THE TRADE....
Our Double Door Furnace
For WOOD or HARD and SOFT COAL.

FRONT RANK
THE most popular and practical article of its kind on the market. The **double doors** will accommodate large pieces of **soft coal** as well as **wood.** The fire-pot is lined with genuine fire clay tiling, which we guarantee for **five years.** The radiation surface in proportion to the grate area is unusually large. ☞ Over **6,000 Front Rank Furnaces** in use in St. Louis alone!! ☜
Write for Catalogue.
FRONT RANK STEEL FURNACE CO.,
Manufacturers of FRONT RANK FURNACES,
Office and Factory, 2301-9 Lucas Av., St. Louis, Mo.

THE HIGHEST EFFICIENCY



4 to 30 H. P.

is guaranteed in every one of the smooth-running BRENNAN GASOLINE MOTORS which are made on the latest approved pattern and are safe, sure and quick to start. Free from vibration. economical in fuel, and of great durability. Four cycle principle. Two distinct types, horizontal and vertical.
BRENNAN MFG. CO., Syracuse, N.Y., U.S.A.

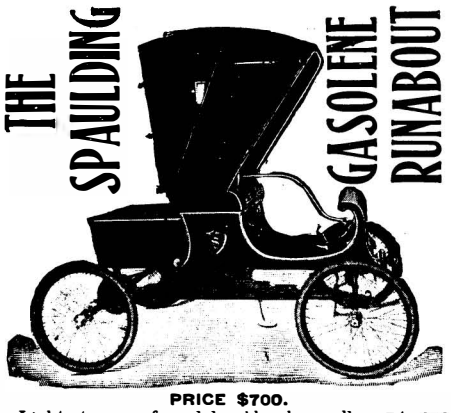
Big Money
is paid at Christmas time for Artistic Novelties. **Learn Pyrography** (Burnt Wood Etching) and you can make the handsomest, best selling articles that will be offered. With our **PANOK OUTFIT,** Pyrography is easily and quickly learned. It is the latest and most popular decorative art, and we give complete lessons and instructions with each outfit. **Our PANOK OUTFIT makes the most useful, instructive, money making present you could give. Write for full details.**
F. F. RICK & CO., 519 Main Street, Buffalo, N. Y.

Orient Motor Cycle.

PRICE $250.00
Fitted with the New Orient 3 H. P. Motor.
Speed over 40 Miles per hour.
The Most Powerful Motor Bicycle in the World.
Write for Particulars. Agents Wanted.
WALTHAM MFG. CO., Waltham, Mass.

CRUDE ASBESTOS
DIRECT FROM MINES
PREPARED ASBESTOS FIBRE for Manufacturers use
R. H. MARTIN,
OFFICE, ST. PAUL BUILDING
220 B'way, New York.

THE SPAULDING GASOLENE RUNABOUT

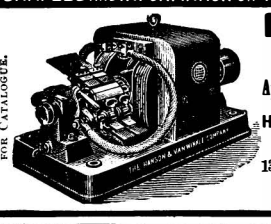


PRICE $700.
Light, strong, safe and durable, above all easy to operate. Has no complicated devices. About everything imaginable has been said in commendation of its style and beauty. Get our catalog.
SPAULDING AUTOMOBILE & MOTOR CO., Buffalo, N. Y.

THE BRIGHT WHITE LIGHT FOR MAGIC LANTERNS
Also for Bromide Enlarging, Copying, Photo-Engraving. Intensely brilliant, very portable, burns kerosene, costs 1 cent per hour. Send for copy Franklin Institute award and lists of Stereopticons, Moving Pictures and Slides.
WILLIAMS, BROWN & EARLE,
Dept. 6, 918 Chestnut St., Philadelphia.

NEW ENGLAND WATCHES
Lead the world in diversity of styles and sizes as well as quantity of production. Our guarantee covers every watch for we make both the case and movement, and sell only a complete watch. Our watches have a world-wide reputation, gained by results as accurate time-keepers. We sell in every country on the globe. Catalogs free.
THE NEW ENGLAND WATCH CO.
Factories: WATERBURY, CONN., U. S. A.

COLD GALVANIZING.
AMERICAN PROCESS NO ROYALTIES.
SAMPLES AND INFORMATION ON APPLICATION.
SEND YOUR BUSINESS CARD FOR CATALOGUE.



NICKEL AND Electro-Plating
Apparatus and Material.
THE Hanson & Van Winkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St. Chicago.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill

CHARTER ENGINE
USED ANY PLACE BY ANY ONE FOR ANY PURPOSE
Stationaries, Portables, Sawing Outfits, Hoisters, Engines and Pumps.
FUEL—Gasoline, Gas, Distillate.
Send for Illustrated Catalogue and Testimonials, and State Your Power Needs.

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL

GARDNER DIE STOCK
4000 GOODS CHEAP
C. H. BESLY & CO 10-12 N. CANAL ST. CHICAGO ILL. U.S.A.

A GOOD INVESTMENT
For $1.75 we will send by express (not prepaid), complete N. D. Outfit with full instructions for learning TELEGRAPH OPERATING.

A fascinating study that will enable you to earn good wages. Send 25 cents for universal dating stamp, by mail, postpaid. Send for our catalog. *Established* 1879.
J. H. BUNNELL & Co. Inc. 20 Park Place New York.

RESTFUL SLEEP
In Camp, on the Yacht and at Home.
"Perfection" Air Mattresses,
CUSHIONS and PILLOWS.

Style 61. Camp Mattress with Pillow attached. Also showing Mattress deflated.
Clean and Odorless, will not absorb moisture.
Can be packed in small space when not in use.
☞ *Send for Illustrated Catalogue.*
MECHANICAL FABRIC CO., PROVIDENCE, R. I.

ALL WHO ARE INTERESTED IN THINGS ELECTRICAL
can obtain our illustrated catalogue by sending 2-cent stamp for postage.
LIBERTY ELECTRICAL SUPPLY CO., 136 Liberty St., New York

Free Test "Royal Worcester" Belting.

We are so confident that this is absolutely the best and most economical power belt to use that we will gladly send trial belt for testing on your own machinery. All you have to do is write us for it, and you are under no obligation to keep it unless it's absolutely satisfactory in every respect.

Write us to-day for belting facts. We have been making old-fashioned oak-tanned leather belting for 50 years, and want you to know how it wears. It will be money in your pocket.

GRATON & KNIGHT MFG. CO.,
Oak Leather Tanners and Belt Makers,
Worcester, Mass.

WANTED
REPRESENTATIVE
Business men wanted for cities of 10,000 and over to open exhibition parlors or stores for the display and sale of our
"KEYLESS CLOCK,"
Just being introduced to the public. Clocks are self-winding and run a year without attention; no one will buy key wound clocks when they see and have an opportunity to buy the latest thing; full line of samples now ready; parties having $500 and upward to invest and ability to manage can secure agency for cities not already taken; parties making arrangements now will have name appear in our advertisements. Address The United States Clock Co., executive offices, No. 405 Broome Street, New York.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS LTD 91 JOHN ST. NEW YORK

Scientific American TRANSPORTATION ON LAND and SEA

SPECIAL ISSUE, appearing under date of **DECEMBER 13, 1902**

HANDSOME COLORED COVER

Similar in size and general character to the **SCIENTIFIC AMERICAN** on the DEVELOPMENT OF THE UNITED STATES NAVY published one year ago

PRICE TEN CENTS

This issue will contain, among others the following articles . . .

UNITED STATES MARINE CONSTRUCTION
Best Types of Ocean Service
Best Types of Lake Service
Lengthening S. S. "New York"

YACHTS
United States and Foreign
Auxiliary
Turbines

RAILROADING
Fastest United States Trains
History of Locomotives
Railroad Signals
Rockville Bridge
Compressed Air Locomotives
Statistics of American Railroads

ELECTRIC TRACTION
10,000 Volt Locomotive
Electric Traction on Steam Railroads
Road Carriages with Trolley
Siemens & Halske Trolley

AUTOMOBILES
Best Types of 1902
Automobiles in Warfare

GENERAL
Miscellaneous Articles, as Transportation of Material

Thirty pages, fully illustrated. Anyone subscribing now for the year 1903 will receive the SCIENTIFIC AMERICAN from the date of subscription, including this Special Number.

Subscription Price $3.00 a Year

MUNN & CO. 361 Broadway, New York

© 1902 SCIENTIFIC AMERICAN, INC.